CAUTION

Do not switch on the display
immediately after moving it from a cold to a warm place.

Condensation on the components
may cause damage or malfunction.

Wait at least one hour for the display to acclimatize.

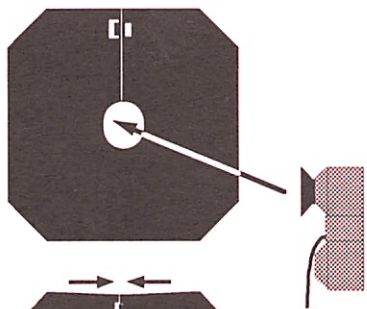
Ambient Light Shield

IMPORTANT

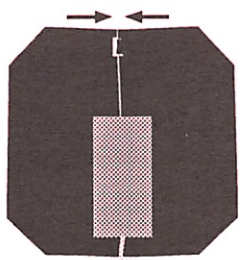
During calibration:

Cover the picture tube by means of the Ambient Light Shield to prevent influence from ambient light!

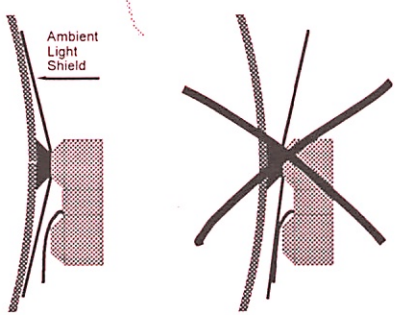
1. Slide the Ambient Light Shield over the rubber suction cup of the Optisense® head.



2. Pull together the flaps of the Ambient Light Shield and fix them by means of the punched lock in the Shield.
As a consequence the shield becomes slightly hollow.



3. Fix the Optisense® head with Ambient Light Shield to the picture tube of the display.



4. After Calibration, remove Optisense® and Shield by pulling at the bottom of the Optisense®.

BARCO n.v.
Information Displays
Theodoor Sevenslaan 106
B-8500 KORTRIJK (Belgium)
Tel. (0) 56 / 23 32 11
Tlx. 85842 BARIND B
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Reference Calibrator® 120T Calibrator® 121

User Manual

V598698 August 1994

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OVERVIEW

1. Introduction to the Reference Calibrator®

Read this chapter before installing or operating the display.

2. How to set-up the Reference Calibrator®

This chapter describes all the steps you should complete during installation of the display, from the unpacking till the moment that you get a picture on the screen.

3. How to calibrate

Read this chapter before calibrating.

4. How to adjust the Reference Calibrator®

This chapter describes all adjustments you have to complete to adjust the Reference Calibrator® to a signal from a mode that is unknown to the display. All of them are protected by a keycode.

5. How to customize the Reference Calibrator®

This chapter describes the mode-independent adjustments.

6. Maintenance

Read this chapter after installation of the display. It describes what you should do to keep the display in optimum shape.

7. Troubleshooting

Read this chapter whenever you experience problems or whenever you think something unusual occurs.

8. Reference

This chapter describes and explains all possible functions and adjustments, in alphabetic order.

Appendix A: Menu structure

This chapter shows the structure of the main menus, and the Diagnose, Input, and Adjust menu.

Appendix B: List of Preset Modes

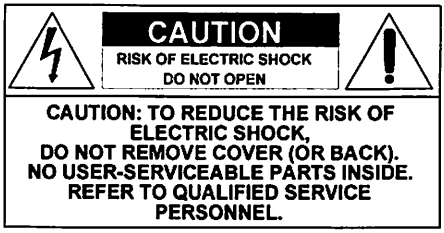
This chapter gives the timing characteristics of the preset modes, factory-stored in the display's memory.

Appendix C: White-point chromaticity coordinates

If you want to define the user-color temperatures in xy-coordinates, you can find the coordinates according to the daylight color temperatures in this chapter.

SAFETY INSTRUCTIONS

• Read the safety and operating instructions before operating the apparatus.
• Retain safety and operating instructions for future reference.
• Adhere to all warnings on the apparatus and in the operating instructions manual.
• Follow all instructions for operation and use.

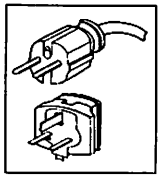


THIS APPARATUS CONFORMS TO THE FOLLOWING RULES:
IEC 950 / EN 60950, UL 1950, C - UL 950

FCC notice
This equipment has been tested and found to comply with the limits of a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

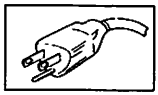
Power connection
• Power requirements: connect the apparatus to an AC voltage as indicated at its back.
Using a lower voltage, the apparatus will not be able to operate. Using a higher voltage may damage the apparatus.
If you are not sure of the type of power supplied, consult the power company.
• Only use the mains lead (U.S. power cord), provided with the apparatus.

• WARNING : THIS APPARATUS MUST BE EARTHED !
The wires in the mains lead are coloured in accordance to the following code :



(CEE7 and British Standard)
Green-and-yellow: Earth (safety earth)
Blue: Neutral
Brown: Live

(ANSI 73.11)



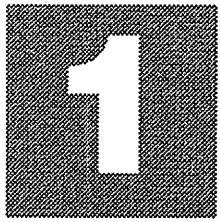
Green-and-yellow: Ground
White: Neutral
Black: Live

• Do not overload wall outlets and extension cords as this may result in fire or electric shock.
• Mains lead protection (U.S.: Power cord): Supply cords should be routed so that they are not likely to be walked upon or pinched by items placed upon or against them, paying particular attention to cords at plugs and receptacles.

Water and moisture
• Never expose the apparatus to rain or moisture.
• Never use the apparatus near water - e.g. near a bathtub, washbasin, swimming pool, kitchen sink, laundry tub or in a wet basement.

Ventilation
• Do not cover or block the ventilation openings in the cover of the set. When installing the apparatus in a cupboard or another closed location, heed the necessary space between the set and the sides of the cupboard.

Installation
• Place the apparatus on a flat, solid and stable surface that can bear the weight of at least 3 monitors. If you use an unstable cart or stand, the set may fall, causing serious injury to a child or adult, and serious damage to the equipment.



INTRODUCTION TO THE REFERENCE CALIBRATOR®

1.1 Facts and features

The Reference Calibrator® 121 and 120T are Barco's newest high-resolution color displays in the Reference Calibrator® product line.

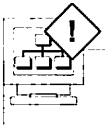
Their internal circuits and easy calibration possibilities guarantee extremely high color fidelity, as well as long-term color stability.

The displays automatically lock to video signals from 30 kHz to 78 kHz (horizontal frequency), and 48 Hz to 120 Hz (vertical frequency). Hence you can connect them to computer systems working in any current graphics mode.

The Barco Reference Calibrator® displays are factory-adjusted to a number of graphics modes, stored in memory, the so-called preset modes.
The first preset mode is completely adjusted and calibrated on the level of geometry and color. The others are adjusted geometrically, but the color temperatures are not calibrated.

If you connect a signal from one of the preset modes, the displays recall the corresponding settings from memory. This means you automatically get an adjusted picture without any additional adjustment.

If you connect a signal from an unknown graphics mode, the displays recall default settings from memory. You get a stable picture with default values for geometry, convergence, color, etc. You can then adjust and calibrate the displays, and store the new mode at another place in memory. The memory can contain 16 different preset modes in total.



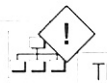
You can't overwrite the factory-stored preset modes.

Other features:

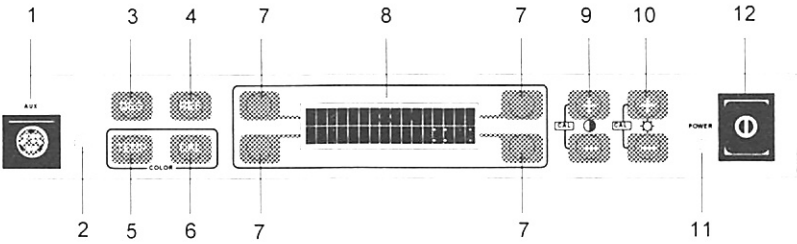
- menu-driven adjustments on LCD display
- remote computer control from supporting software
- 3 factory-defined and 2 user-defined color temperatures
- color temperatures definable up to 20000 K
- built-in orbiter to prevent picture burn-in
- automatic adaptation to power voltages from 90V-135V and 195V-265V, 45 Hz - 65 Hz

1.2 Connections and controls

Control panel at the front



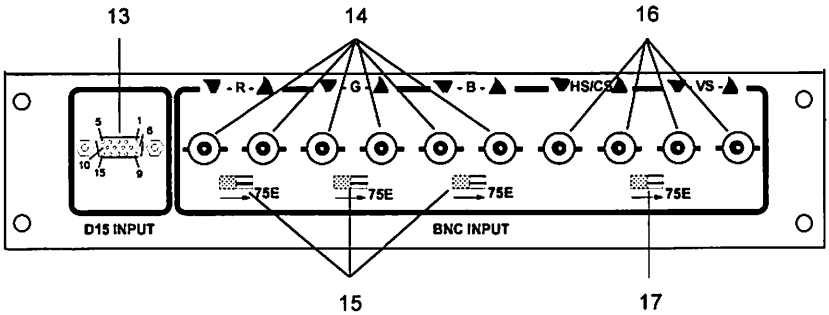
The control panel at the front is completely disabled when the Reference Calibrator® is controlled from the Calibrator®Talk software.



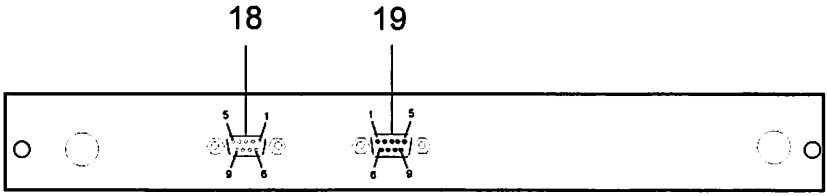
1 Auxiliary connector for connection of Thoma color analyzer.
2 ALC sensor.
3 Degauss key for immediate demagnetization.
4 Reference key. Wherever you are in the menu structure, pressing the REF key immediately brings the picture back to a reference position.
5 Color temperature selection key to select a color temperature.
6 Color calibration key for automatic calibration of the color temperature(s) of the current preset mode.

7 Soft keys.
8 LCD display.
9 PICTURE controls, up and down.
10 BACKGROUND controls, up and down.
11 Power indicator.
12 Power switch.

Input panel at the rear



13 Video and sync input: mini D-Sub 15-pin connector, e.g., for VGA input.
14 BNC connectors, inputs for R, G, B analog or for R, G+sync, B analog.
Two internally linked connectors per color for loop-through applications.
Video levels: 700 mV black to white, pos. or neg.
15 75Ω termination switches for R, G and B resp.
Put them in the '75E' position on a stand-alone display or on the last display in a chain. Put them in the other position (>10kΩ) on all other monitors in a chain.
16 BNC connectors for separate vertical and horizontal sync or composite sync input.
Two internally linked connectors per sync input for loop-through applications.
The display automatically detects whether you apply separate or composite sync.
Sync levels: 0.5 - 4 Vpp, pos. or neg.
17 75Ω termination switch for the sync inputs.
Put it in the '75E' position on a stand-alone display or on the last display in a chain. Put it in the other position (>10kΩ) on all other monitors.



18 Female mini D-sub 9-pin connector Remote In.
This is a serial input to adjust the display from an external computer, probably from supporting software, like Calibrator®Talk.
Can handle the following standards:
- RS-232
- RS-422
- RS-485 (inter-monitor bus)

19 Male mini D-sub 9-pin connector Remote Out.
Connect it to the following display's Remote In in case of a loop-through application.
Standard: RS-485 (inter-monitor bus).

1.3 About the LCD

The LCD display on the front has two major functions:
a) supplying you with information about the display
b) allowing you to perform a number of controls

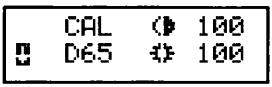
Soft keys

There are four function keys next to the LCD panel. By means of these keys you can 'travel' through the menus on the LCD, change values, or start certain tasks.
Because their function always depends on the contents of the LCD panel, we call them soft keys.
The function of a soft key is indicated in the corner of the LCD, next to the key it relates to.

Dimmed LCD

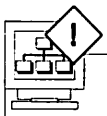
If you don't use the keyboard for about five minutes, the Reference Calibrator® automatically dims the LCD. It lights again when you press one of the keys on the keyboard.
The first time you press a key while the LCD is dimmed, the corresponding function is not activated; only the LCD lights. Press the key once more to activate its function.
You can set the illumination level in the Adjust menu. This is explained in the chapter "How to customize the Reference Calibrator®".

Main menu screen



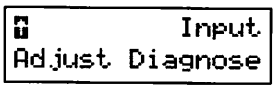
During normal operation the LCD displays the so-called main menu screen.
This gives you the following information:

- The display is currently calibrated.
- The current color temperature is D65 (6500 Kelvin).
- Both PICTURE and BACKGROUND controls are in calibrated position.



You cannot use the keys on the display while the display is controlled by a computer. In that case the LCD displays the message `Communicating...Keyboard locked` instead of the main menu.

Other menus



You get access to other information and other controls by pressing the soft key next to the ▲ icon. The LCD displays the following menu screen.

The `Diagnose` menu gives you useful information, especially in case of trouble.

The `Input` menu allows you to switch to another video input.

The `Adjust` menu allows you to adjust and customize the display.

Parameter values

Most of the parameters on the LCD range from 0 to 1000. 0 is indicated as min, while 1000 is indicated as max.

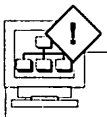
Icons

Next to readable text, the LCD additionally displays icons that have a particular function.

The different icons are:	
▼	Go to the next menu screen.
▲	Go to the previous menu screen.
▶	Jump to the next item in the Adjust menu.
◀	Jump to the previous item in the Adjust menu.
`Exit`	Quit a menu and go to the main menu.
`Quit`	Quit a menu and go to the previous menu screen.
→→→	Select character to modify.
^	Current character to modify.
`Enter`	Enter values.
+	Increase values or scroll up through a list.
-	Decrease values or scroll down through a list.

HOW TO SET-UP THE REFERENCE CALIBRATOR®

2.1 Unpacking



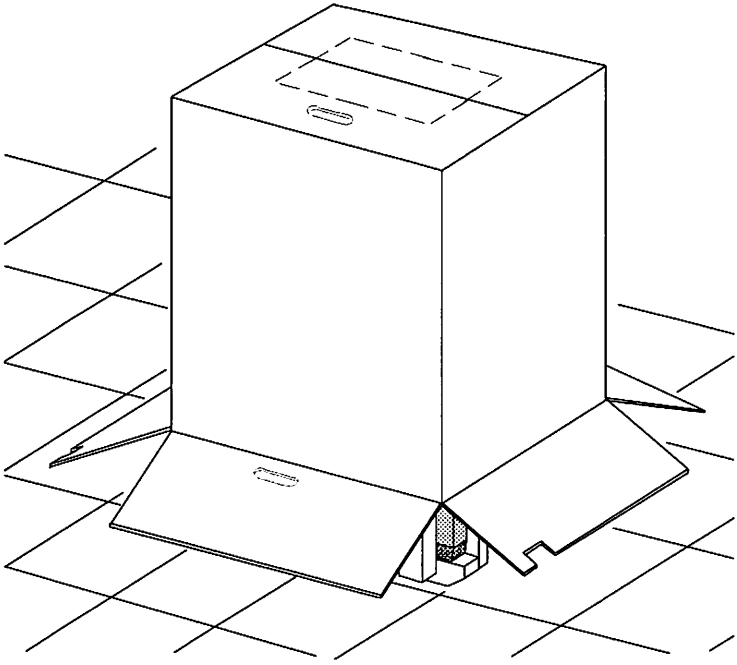
The Reference Calibrator® display weighs about 40 kg. Don't lift it all by yourself to avoid injury.

Inspect the contents of the box:

- The Reference Calibrator® display with incorporated Optisense® light probe.
- Calibrator®Talk software package with cables.
- Geo- or Accessory box with User Manual, power cord, and possible accessories.

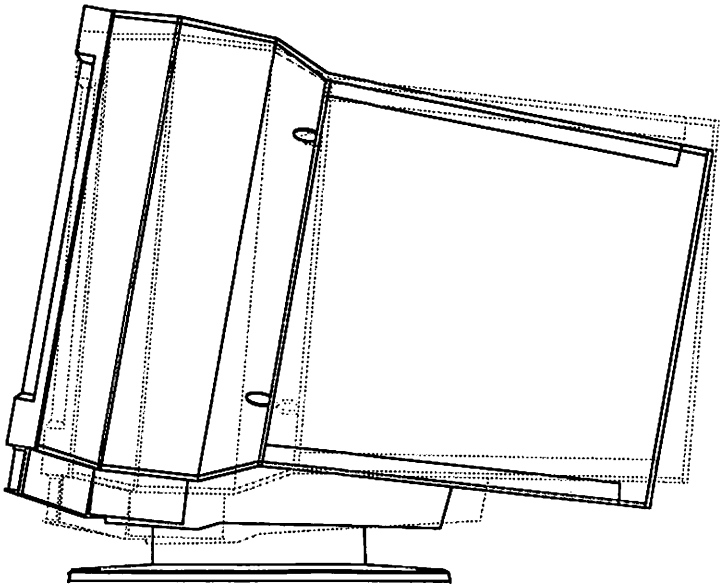
To remove the display from the box:

1 Position the box with DISPLAY side facing up.
2 Open the DISPLAY side and completely bend over the flaps.
3 Tilt the box to its side and keep the flaps bent over.



4 Tilt the box to the DISPLAY side.
5 Slide the box upward. The display, packed in two polystyrene pieces, is standing on the ground with its picture tube facing down.
6 Place the display on its foot and remove the polystyrene pieces.
7 Remove the plastic bag around the display and the foam piece between the foot and the display.

Place the display on a strong table or desk.
Avoid reflections in the picture tube from windows and lights.
The display's tilt and swivel base allows you to position the display at an ergonomically sound viewing angle.

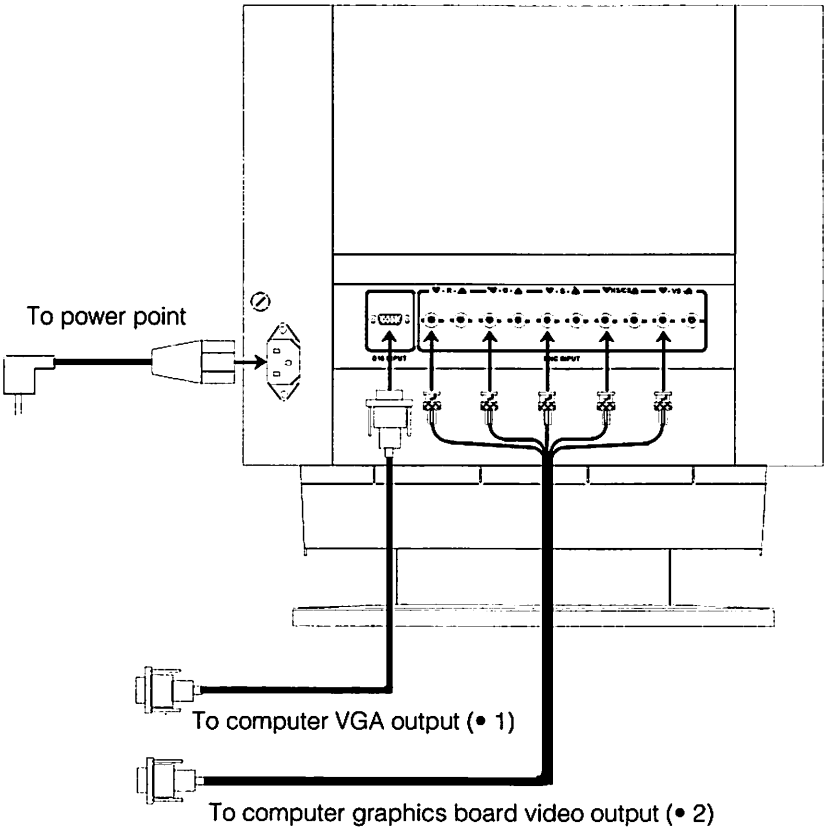


Keep your original packaging. It is designed for this display and is its ideal protection during transport.

2.2 Connecting the signals

Connecting mains, video and sync signals

The connection to the Mini D-Sub 15-pin connector is much more sensitive to interference than the connection to the BNC connectors. That's why we recommend to use the BNC inputs for applications where color accuracy is extremely important.



- 1 Input possibilities:
  - standard VGA signals

Mini D-Sub 15	
1	R
2	G
3	B
4	ID 2: GND
5	GND
6	GND
7	GND
8	GND
9	Not connected
10	GND
11	ID 0: GND
12	ID 1: not connected
13	H Sync
14	V Sync
15	Not connected

WARNING
In case you use the Sub-D15 input, **only** use the following VGA / BNC cable to avoid RF interference:

DATAFLEX type **AK8115**
Part no. K344073

- 2 Input possibilities: Priority:
  - RGB with separate H&V Sync 1
  - RGB with composite Sync 2
  - RGB with composite Sync on Green 3

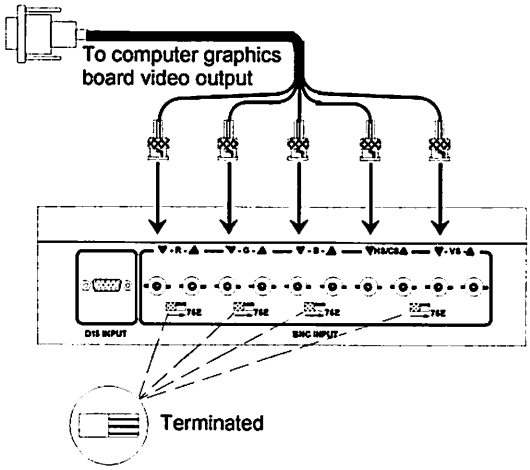
Position of termination switches:
- "75E" on stand-alone display or last display in a chain
- Other position on other displays in a chain

Connection for Remote computer control

One single display

To control one single display by a computer, proceed as follows:

1 Connect the computer graphics board video output to the BNC video input by means of a video cable.
2 Put all "75E" termination switches on the display in the "75E" position.

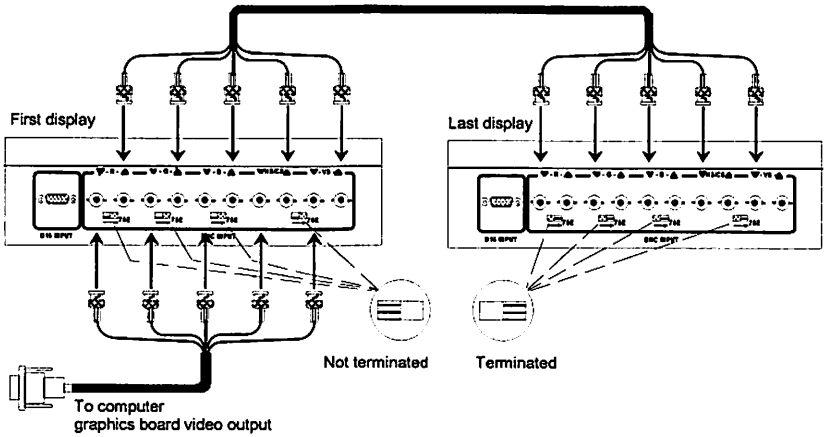


3 Connect computer serial port to Remote In connector on display by means of a control cable.
4 If necessary, set the display's communication time-out.
Refer to § 5.5 "Setting the communication time-out".

Several displays

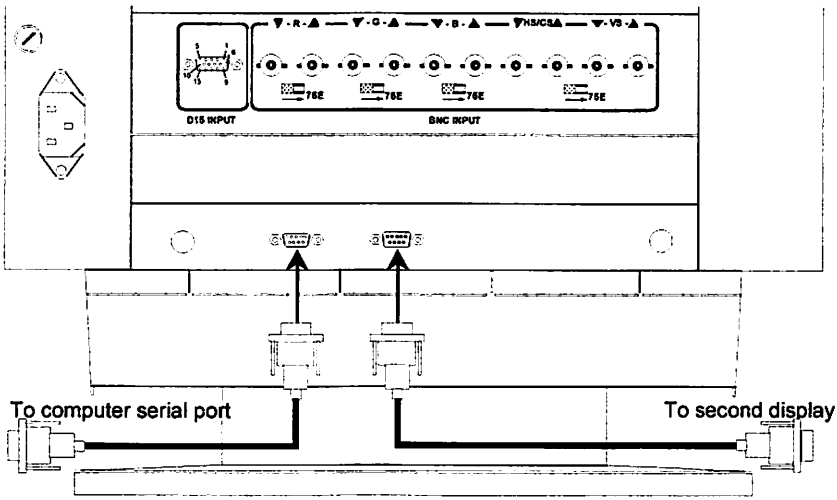
To control several displays, proceed as follows:

1 Connect the computer graphics board video output to the BNC video input of the first display in the chain by means of a video cable.
2 Connect the BNC video output of the first display to the video input of the next one, etc.
3 Put all "75E" termination switches on the last display in the "75E" position. Put them in the other position on all preceding displays.



4 Connect computer serial port to Remote In connector on first display by means of a control cable.

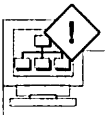
5 Connect Remote Out of first display to Remote In of next one, etc.



6 Give a different address to each display in the chain.
Refer to § 5.4 "Setting the display address".

7 If necessary, set the display's communication time-out.
Refer to § 5.5 "Setting the communication time-out".

	Remote In plug		Remote Out plug
1	Ground	1	Ground
2	RS-232 data out	2	Not connected
3	RS-232 data in	3	Not connected
4	RS-485 data out (-)	4	RS-485 data out (-)
5	RS-485 data in (-)	5	RS-485 data in (-)
6	Not connected	6	Not connected
7	Ground	7	Ground
8	RS-485 data out (+)	8	RS-485 data out (+)
9	RS-485 data in (+)	9	RS-485 data in (+)



You must set the LCD on the display in its main menu to control the Reference Calibrator® by computer.
During the computer session, the display keyboard is locked, which is indicated on the LCD.

2.3 Turning on the display

Press the power switch on the front. The Reference Calibrator® will start up. At this moment, the display will be demagnetized.

During start-up the following message appears on the LCD display:
This is an indication of the display type.

After start-up, the main menu screen appears.

The Reference Calibrator® has a number of preset modes stored in its memory. They are all adjusted geometrically, and the first one is additionally factory-calibrated on the five color temperatures.

If you have connected a signal from one of the preset modes, the display recalls the corresponding settings from its memory.
In that case the picture is adjusted, without any additional adjustments.

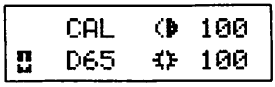
If you have connected a signal from an unknown mode, the display recalls default settings from the memory.
You should then adjust the display to the new signal and store the settings as a new mode in the memory.
In Chapter 4 "How to adjust the Reference Calibrator®", you can read how to do this.

In case you want to re-calibrate the color temperatures, refer to Chapter 3 "How to Calibrate".

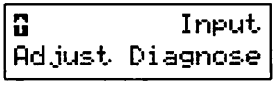
2.4 Selecting an input

During start-up, the Reference Calibrator® detects to which input you have connected a signal. It will automatically select this input.
In case you have connected a signal to both inputs, the Reference Calibrator® selects the last chosen input.

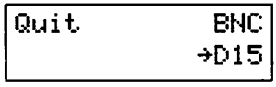
However you can still select the other input manually. Proceed as follows:



After start-up the display shows the main menu screen.
Press the ⇕ soft key.



Press the Input soft key.



The → indicator shows the currently selected input.
Press the soft key corresponding to the input you want.

Press the Quit soft key to return to the previous menu screen.

2.5 Selecting a color temperature

The Reference Calibrator® keeps track of five different color temperatures: three factory-defined and two user-defined color temperatures. The main menu screen always displays the current color temperature.
The default mode, however, has restricted color possibilities. Here you only have one color temperature: D65.

To select another color temperature:

Press the TEMP key on the keyboard.

The current color temperature is now displayed.

Press the ◘ or ◘ soft key to select another color temperature.

The color temperatures appear in the following order:

Color temperature	Indication on the LCD
5300 Kelvin	D53
6500 Kelvin	D65
9300 Kelvin	D93
User 1	US1
User 2	US2

In case you are operating in Default mode, you can't select another color temperature. You only dispose of D65.

Press `Quit` after selecting the color temperature.

2.6 Adjusting PICTURE and BACKGROUND controls

Adjustment

PICTURE control adjusts the display's contrast.
BACKGROUND control adjusts the display's brightness.

Press the + key to increase, and the - key to decrease PICTURE and BACKGROUND controls. Meanwhile the LCD display shows the value you are adjusting.

Calibrated position

The calibrated position of PICTURE and BACKGROUND is always set to 100.
Press the + and - keys simultaneously to reset PICTURE and BACKGROUND controls in their calibrated position, if they are not.

The calibrated position of PICTURE and BACKGROUND is a relative value that was determined during calibration.
This value can be different for every color temperature and for every preset mode. That is why PICTURE and BACKGROUND can have different maximum limits per color temperature.

Saving changes

The PICTURE AND BACKGROUND values are automatically stored in the memory.
So when you adjust them, their last setting is retained at power-off.
As a consequence the display always starts with the PICTURE and BACKGROUND values from before the last power-off.

Ambient Light Control

You can leave the PICTURE adjustment to your Reference Calibrator® display, if you wish.
An internal circuit, called Ambient Light Control (ALC), can automatically adjust PICTURE control, taking the ambient light intensity into account.
This is indicated on the LCD display: The value for PICTURE is replaced by "ALC".

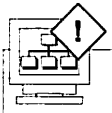
If you are not satisfied with the ALC's PICTURE setting, you can still increase or decrease PICTURE control, after which the ALC operates, considering your new setting.

Refer to § 5.2 "Customizing the ALC" for more information.

2.7 Return to reference picture

Wherever you are in the menu structure, pressing the REF key on the keyboard immediately brings the picture back to a reference position:

- PICTURE and BACKGROUND controls in calibrated position.
- The three colors switched on.
- ALC switched off.
- The settings for the current preset mode, as they are stored in the memory:
  - mode name and timing
  - all geometry settings
  - convergence and uniformity settings
  - all parameters of the current color temperature



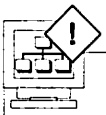
The Reference position isn't necessarily a calibrated position.

Reason: the Reference Calibrator® leaves the factory as a calibrated display for the first preset mode that is stored in its memory.
You can change and store these settings without doing a new calibration. In that case, the stored settings are no longer calibrated settings.
Only after re-calibration, they will be.

2.8 Demagnetizing the display

Remanent magnetism, caused by moving the display during operation, causes discoloration on the screen.

Remove the 'hot spots' on the screen by pressing the DEG key.
As a consequence, the picture will shiver for a moment.



The display is always demagnetized after you have switched on the power.

The Reference Calibrator® displays are equipped with a so-called Quick Degauss system. This system has the following advantages:

- The demagnetization action is much faster.
- The image shivers less.
- The necessary time between two demagnetization actions is very small: 7 seconds.

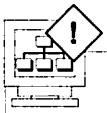
In case you want more information about the demagnetization (or degauss) system in your display, please contact your local dealer.

HOW TO CALIBRATE

It is important to calibrate the currently used color temperatures regularly. That is why the Reference Calibrator® prompts you to do a re-calibration after a certain time of operation. This time is approximately 300 hours. In that case the message "Recalibration required" is displayed during start-up.

Recalibration required

Calibration can easily be done by means of the Optisense® light probe that is incorporated in the tilt and swivel base of your Reference Calibrator®.



Use your Ambient Light Shield during calibration!

The calibrated position

A color display's calibrated position is a combination of color on the one hand, and geometry, uniformity, and convergence on the other hand. This means that you are out of calibrated position from the moment you change one of the above mentioned parameters. This also means that you can be in calibrated position when you operate in one preset mode, whereas you are not in calibrated position in another mode. The reason for this is, that the display has different geometry settings in different modes.
The Reference Calibrator® will indicate this on its LCD panel: The word CAL in the main menu changes to UNCAL.

The Reference Calibrator® contains five color temperatures and several preset modes in its memory. The five color temperatures are calibrated in the factory on the first preset mode. This means that the other preset modes are adjusted geometrically, but the color temperatures are not calibrated. You can calibrate them by means of the Optisense®.

Re-calibration: When?

You should re-calibrate your regularly used color temperatures in the following cases:

- The LCD shows the message Recalibration required.

- You have changed any parameters from geometry, uniformity, convergence, or color temperature in the Adjust menu. In that case the LCD shows UNCAL.
- Any other case when the LCD displays UNCAL instead of CAL.

You can perform a re-calibration at any time, regardless of the menu on the LCD. When you have changed any of the parameters in the Adjust menu, the display first asks you to save the changes. If you confirm, you can additionally select the mode number where you want to store these changes. This will also be the mode the display will re-calibrate.

In case of changing the color temperature

The user color temperatures are factory-defined to D50 and D200.
In case you want to define one of them, or both, to another value, you should first define that new value in the Adjust menu. Second, you should calibrate the new color temperatures in every preset mode you want to use.

In Chapter 4 "How to adjust the Reference Calibrator®", you can read how to define the user color temperatures to a new value.

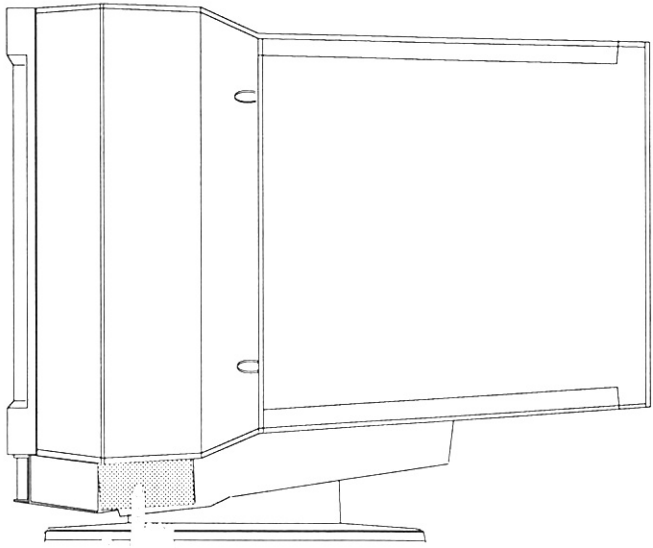
The display and the Optisense® should be warmed up before starting a (re-)calibration. Only then you can have optimum results. We suggest 30 minutes as warming-up period.

Calibrating one color temperature

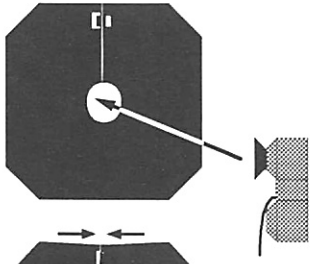
1 Select the color temperature you want to calibrate by means of the TEMP key.
2 Pull the Optisense® light probe out of the tilt and swivel base.
3 Fix the light probe in the middle of the screen.
4 Dim the light in the room or use your Ambient Light Shield. This is necessary because the ambient light influences the calibration.
5 Press the CAL key.
You can now choose to calibrate all 5 color temperatures, or only the current one.

6 Select the current one by pressing the corresponding soft key.
The currently selected color temperature is now calibrated. This might take about two minutes.

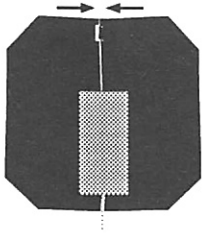
7 During the procedure, the LCD displays the color temperature it is adjusting. To stop the procedure, press Abort.



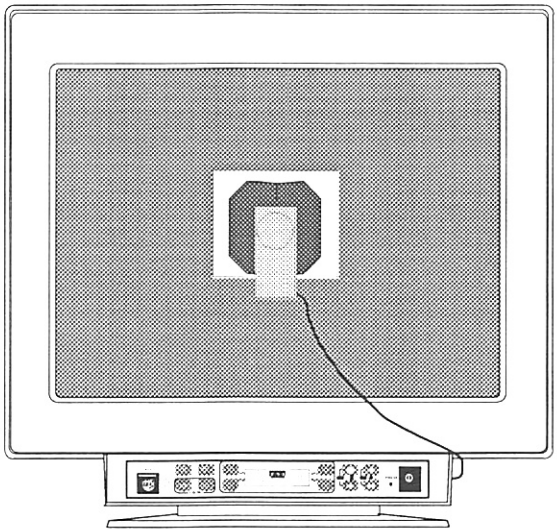
Push against the side panel.
The light probe comes out.



Fix the Ambient Light Shield to the Optisense.



Lock the Ambient Light Shield.



Position the light probe, with Ambient Light Shield, in the middle of the screen.

Calibrating all 5 color temperatures

1 Pull the Optisense® light probe out of the tilt and swivel base.

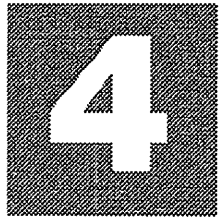
2 Fix the light probe in the middle of the screen.

3 Dim the light in the room or use your Ambient Light Shield. This is necessary because the ambient light influences the calibration.

4 Press the CAL key.
You can now choose to calibrate all 5 color temperatures, or only the current one.

5 Press the All soft key.
The five color temperatures are now calibrated. This might take about ten minutes.

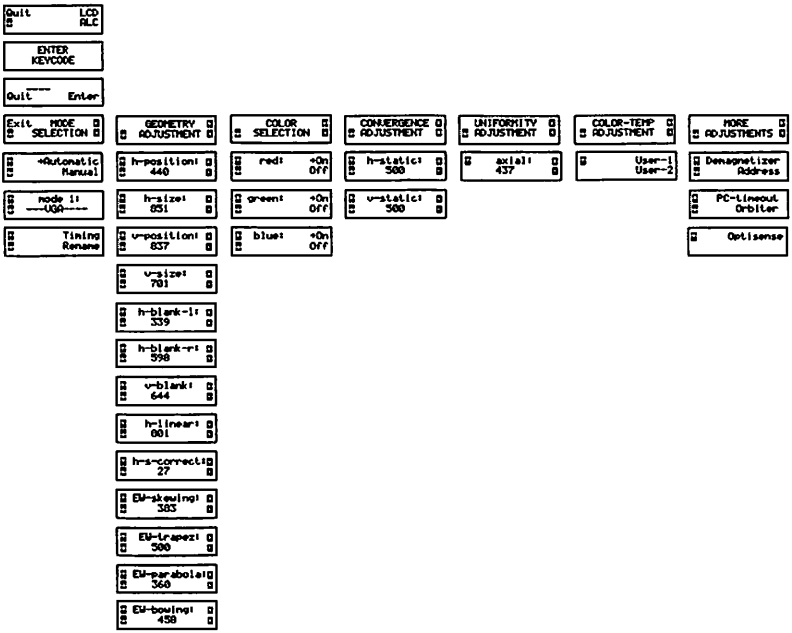
6 During the procedure, the LCD displays the color temperature it is currently adjusting. To stop the adjustment of that color temperature, press Abort.



HOW TO ADJUST THE REFERENCE CALIBRATOR®

How to use the Adjust menu

- To adjust the Reference Calibrator®, you need to enter the Adjust menu. This is built up in a logical sequence.
  So it is possible for a novice user, feeling unsure about doing the adjustments, to perfectly adjust the display by following the complete sequence.
  The following figure shows the complete Adjust menu.



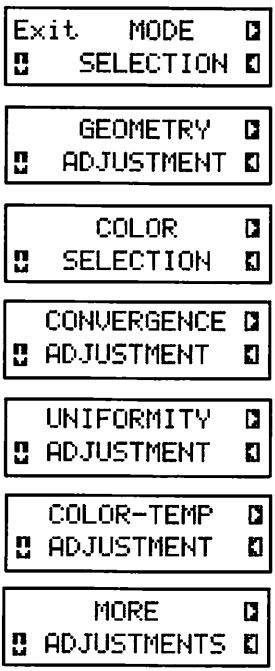
Note: In Default mode, the Color Temp Adjustment menu is not present.

- More experienced users, on the other hand, need not always perform all the functions in the menu. When they look at an image, they know what they need to adjust, and what they don't.

They can use the operators to 'walk' through the menu and quickly access the functions they need.
The different operators are:

- ▲: go to the (next) adjustment in an item
- ▼: go to the previous adjustment in an item
- ▶: jump to the next item directly
- ◀: jump to the previous item directly

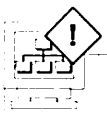
The complete procedure



- The complete Adjust menu is composed of seven main items.

Each item is composed of several adjustments.

The last item (More Adjustments) contains a number of mode-independent adjustments. They are described in chapter 5: How to customize the Reference Calibrator®.



After changing any of the adjustments in the items geometry, convergence, axial uniformity and color, the Reference Calibrator® will not be calibrated anymore. This is indicated on the LCD by the word UNCAL.
So always re-calibrate after each adjustment of these items.

Test Patterns

The Reference Calibrator® 120T & 121 doesn't dispose of an internal test pattern generator. Nevertheless it is better you display a test pattern while doing the adjustments. Contact your local dealer for information about the necessary test signals.

The test patterns you need are:

- White cross hatch on a black background for geometry and convergence.
- Uniform white field over the complete screen for uniformity.

Saving changes

The changes you make in the Mode Selection menu are automatically saved.

You get 4 occasions to save the changes in the other menus:

a) when you exit the adjustment procedure by pressing Exit.
b) when you select another preset mode without having saved first .
c) when you press the CAL key on the keyboard while you have changed some parameters in the Adjust menu.
d) when the frequency of the connected signal suddenly changes or the signal disappears.

To save the changes:

1 Press Yes to save the changes.
The following screen lets you select the mode number where to save them.

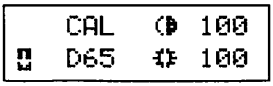
2 Press the ▲ or ▼ soft key to select the mode number where you want to save the changes.

3 Press the OK soft key to actually save the changes.
The display now operates in the mode you have saved.

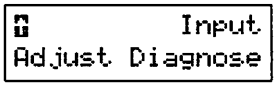
Entering the Adjust menu

The Adjust menu is protected by a keycode. Once you have entered the correct code, you can run through the complete procedure without having to enter the code again.

To enter the Adjust menu:



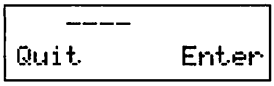
1 From the main menu screen, press the ▯ soft key.



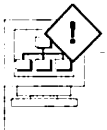
2 Press the Adjust soft key.

3 Press the ▯ soft key.
The message "Enter Keycode" appears for a few seconds.

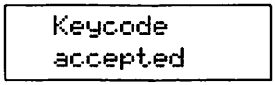
4 Enter the keycode.



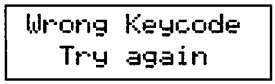
5 Press the Enter soft key.



You enter the keycode by pressing the REF key on the front panel 4 times.



If you have entered the correct code, the LCD displays the message "Keycode accepted" for a few seconds and then displays the first item in the adjustment procedure.



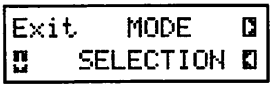
If you have entered the wrong code, it displays the message "Wrong keycode. Try again" for a few seconds and then returns to the previous menu screen.

4.1 Mode selection

The first thing you do before you start the real adjustment, is select the preset mode you want to adjust.

As already explained, the Reference Calibrator® can retain 16 different modes in its memory. Five of them are adjusted and fixed in the factory. You have 11 spare memory places to store other modes.

In case you have connected a signal that doesn't match one of the preset modes in the memory, the Reference Calibrator® operates in Default mode. Here you have restricted possibilities. You should select a free mode number where you want to store the new mode.



In the `Mode Selection` menu, you can select automatic or manual mode selection, you can manually switch to another mode, rename the chosen mode, and view its timing characteristics.

In case you don't need to select another mode, jump to the next item.

Automatic / Manual

When set to Automatic, you let the Reference Calibrator® select the preset mode. It automatically detects the timing characteristics of the connected signal and recalls the corresponding settings from its memory.
When set to Manual you manually select a preset mode.

To switch between Automatic and Manual selection:

1 Press the soft key.
2 The indicator → shows the current setting. If you want to change this, press the corresponding soft key.

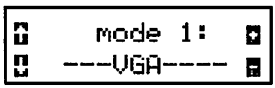
Any changes you make here are automatically saved.

Selecting another mode

You can only switch to another preset mode in case you have selected manual mode selection.

To select another mode:

1 Press the Manual soft key to select manual selection.



2 Press the ▲ soft key to continue. The following menu screen shows the number and name of the currently selected preset mode.

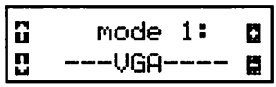
3 Press the ▲ or ▼ soft keys to select another preset mode.

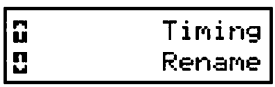
Any changes you make here are automatically saved.

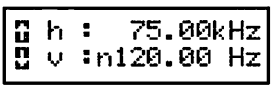
Viewing the timing

You can ask for the timing of the current preset mode, i.e., the horizontal and vertical frequency and vertical sync polarity, as stored in the memory.

To view the timing characteristics of the selected mode:







1 Press the ▲ soft key.

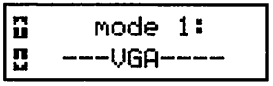
2 Press the Timing soft key. The following menu screen shows the timing of the current preset mode, as stored in the memory. The screen from the following figure tells you that the horizontal frequency of this signal is 75 kilohertz, the vertical frequency is 120 Hertz, and the vertical synchronization pulses have negative polarity.

3 Press the ▲ soft key to return to the previous menu.

Renaming

Use this function to rename the current preset mode or to enter the name of a new mode.

To rename the selected mode:



1 Press the ◘ soft key.

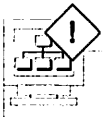
2 Press the Rename soft key. The following menu screen shows the name of the current preset mode.
The ^ indicator shows the character that you can modify.

3 Press the →→→ soft key to position the ^ indicator under the character you want to modify.

4 Press the ◘ and ◘ soft keys to modify the character.

5 When you have finished, press the ◘ soft key to return to the previous menu screen.

Any changes you make here are automatically saved.



You can't rename the Default mode. First select a free mode number when operating in Default mode.

4.2 Geometry adjustments

After having selected the preset mode, you can start the real adjustment. If necessary, adjust geometry first.

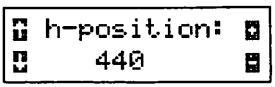
If you don't need to adjust geometry, use the ▯ soft key to jump to the following item or the ◧ soft key to jump to the previous one.

To perform the Geometry adjustments:

1 Press the ▯ soft key to step forward through the geometry adjustments. They appear in the order mentioned below.
2 You can always step back to previous geometry adjustments by means of the ▯ soft key.
3 Use the ▯ and ▯ soft keys to change the necessary values.
4 After the last adjustment, you return to the start of the `Geometry Adjustment` menu by pressing the ▯ soft key.
5 Press the ▯ soft key to jump to the next item.

The geometry adjustments are:

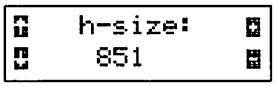
Horizontal position



Adjust to center the picture horizontally.

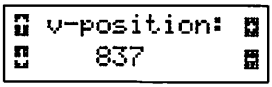
Horizontal size

Adjust to obtain the following picture width:



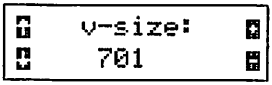
Reference Calibrator® 121: 373 mm.
Reference Calibrator® 120T: 360 mm.

Vertical position



Adjust to center the picture vertically.

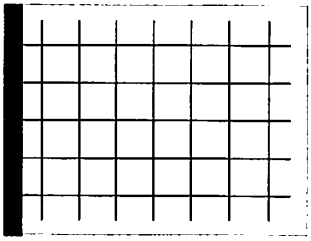
Vertical size



Adjust to obtain the following picture height:
Reference Calibrator® 121: 280 mm.
Reference Calibrator® 120T: 270 mm.

Horizontal blanking left

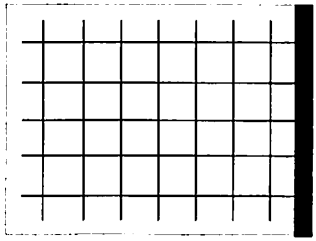
First increase BACKGROUND so that the dark border around the visible picture lights up. This is what we call the background of the picture.



Adjust so that the left part of the background is completely blanked away without any loss of the picture.

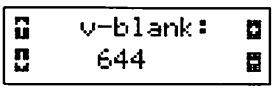
Horizontal blanking right

First increase BACKGROUND so that the dark border around the visible picture lights up. This is what we call the background of the picture.

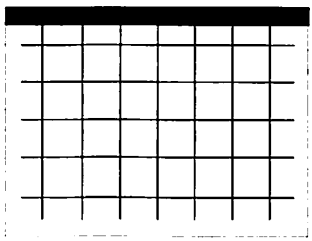


Adjust so that the right part of the background is completely blanked away without any loss of the picture.

Vertical blanking

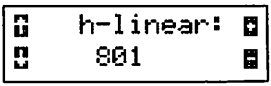


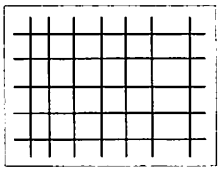
First increase BACKGROUND so that the dark border around the visible picture lights up. This is what we call the background of the picture.

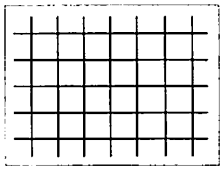


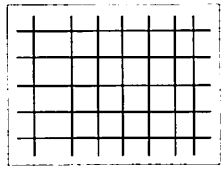
Adjust so that the upper part of the background is completely blanked away without any loss of the picture.

Horizontal linearity

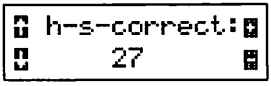


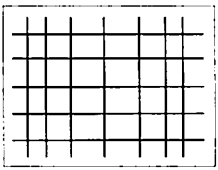

Bad

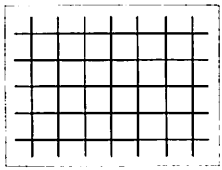

Good

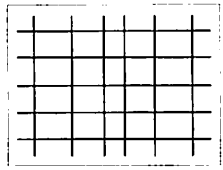

Bad

Horizontal S-correction

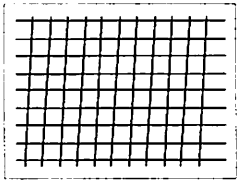


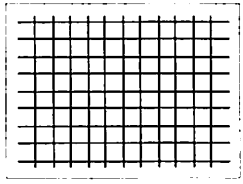

Bad

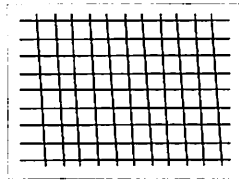

Good


Bad

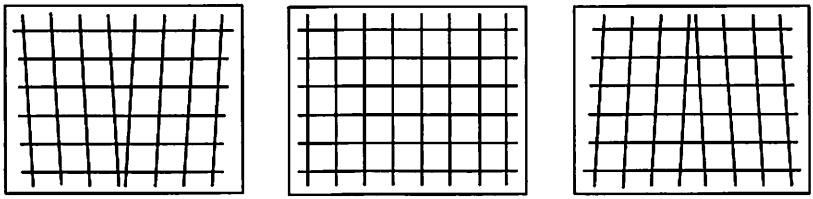
East-West skewing


Bad


Good

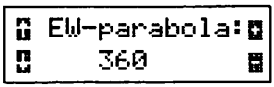

Bad

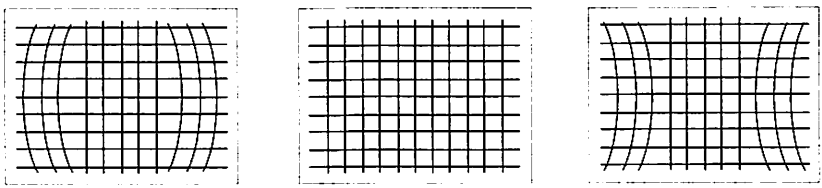
East-West trapezium



Bad Good Bad

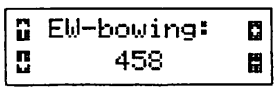
East-West parabola

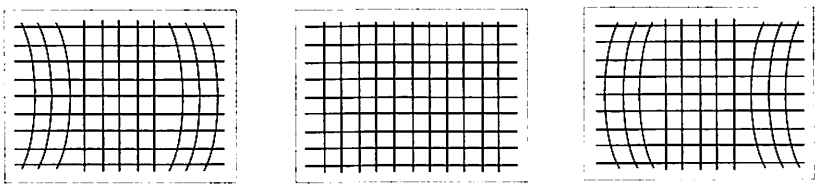




Bad Good Bad

East-West bowing



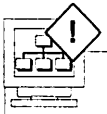


Bad Good Bad

4.3 Color selection

For the adjustment of convergence or uniformity you might find it useful to switch off one or two colors, e.g., to create a uniform red square on the screen.

For that purpose the Adjust menu provides this feature. If you don't need it, use the ▯ soft key to jump to the following item or the ◧ soft key to jump to the previous one.



All colors are automatically reset after quitting the Adjust menu, or after pressing the Ref key on the keyboard.

To switch colors on or off:

1 Press the ▯ soft key to step forward. The adjustments appear in the order shown alongside.
2 You can always step back to the previous convergence adjustment by means of the ▯ soft key.
3 Press the Off soft key to switch off a color.
4 After the last adjustment, you return to the start of the Color Selection menu by pressing the ▯ soft key.
5 Press the ▯ soft key to jump to the next item.

4.4 Convergence adjustments

After having adjusted geometry, adjust the convergence.

If you don't need to adjust convergence, use the ▷ soft key to jump to the following item or the ◁ soft key to jump to the previous one.

To perform the convergence adjustments:

1 Press the ▽ soft key to step forward in the convergence adjustments. The adjustments appear in the order mentioned below.
2 You can always step back to the previous convergence adjustment by means of the △ soft key.
3 Use the + and − soft keys to change the necessary values.
4 After the last adjustment, you return to the start of the Convergence Adjustment menu by pressing the ▽ soft key.
5 Press the ▷ soft key to jump to the next item.

Horizontal static convergence

Observe the center of the screen during the adjustment.
Press the + soft key to move blue colors to the right and red colors to the left.
Press the − soft key to move blue colors to the left and red colors to the right.

Vertical static convergence

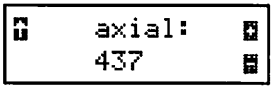
Observe the center of the screen during the adjustment.
Press the + soft key to move blue colors upward and red colors downward.
Press the − soft key to move blue colors downward and red colors upward.

4.5 Axial uniformity adjustment

After having adjusted the convergence, adjust axial uniformity.

If you don't need to adjust axial uniformity, use the ▯ soft key to jump to the following item or the ◧ soft key to jump to the previous one.

To perform axial uniformity adjustment:



1 Press the ▯ soft key.
2 Display a uniform white picture on the screen.
You might notice some darker spots on the screen.
3 Press the ◧ soft key or the ▯ soft key to eliminate the spots.

4.6 Color temperature definition

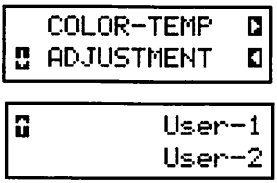
The last step in the Adjust menu is the definition of the 2 user-defined color temperatures you want to work with. After this last step you can calibrate your colors.

You can define the user-color temperatures in 2 different ways: expressed in Kelvin and expressed in xy-coordinates.

If you don't need to define the color temperatures, use the ▯ soft key to jump to the following item or the ◧ soft key to jump to the previous one.

This menu is not present when you work in Default mode.

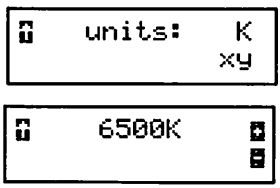
To define the user color temperatures:



1 Press the soft key.
2 Press the soft key according to the user-defined color temperature you want to define.

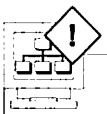
Now you have to select how you want to define the color temperature: expressed in Kelvin units or in xy-coordinates.

Expressed in Kelvin units



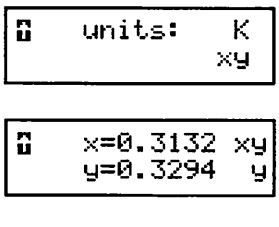
a) Press the K soft key to select Kelvin units.
b) Press the or soft key until the desired color temperature in Kelvin is displayed. The value changes in steps of 100 Kelvin.
The minimum is 5000 K, the maximum is 20,000 K.
c) Press the soft key to return.

Expressed in xy-coordinates



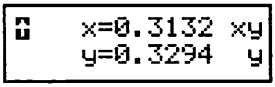
Refer to Appendix C for the list of xy coordinates.

To define the color temperature in xy-coordinates:



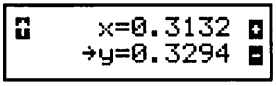
a) Press the xy soft key to select xy-coordinates.
b) To determine the x-coordinate, press the xy soft key again.
c) Press the or soft key to change the x-coordinate.
Notice that the y-coordinate changes accordingly because you are moving the color point along the Daylight curve.

d) Press the ↑ soft key to return to the previous menu screen.



e) Now press the y soft key to change the y-coordinate only.

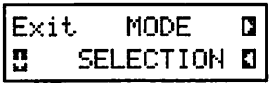
f) Press the + or − soft key to change the y-coordinate. Now the x-coordinate doesn't change accordingly.



g) Press the ↑ soft key.

4.7 Quitting the Adjust menu

To conclude the Adjust menu:



1 Go to the Mode Selection menu.

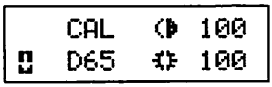
2 Press the Exit soft key.

If you have made any changes in the Adjust menu, the Reference Calibrator® asks you to save the changes.

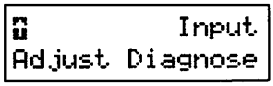
HOW TO CUSTOMIZE THE REFERENCE CALIBRATOR®

5.1 Adjusting the LCD backlight

You can adjust the LCD illumination from 0 to 15.
To adjust the illumination (backlight) of the LCD display:

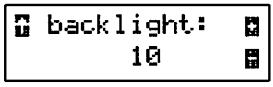


1 From the main menu screen, press the ▯ soft key.



2 Press the Adjust soft key to enter the Adjust menu.

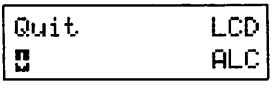
3 Press the LCD soft key. The following menu screen appears, displaying the current backlight setting.



4 Press the ▯ soft key to increase, or the ▯ soft key to decrease the illumination (backlight) of the LCD. Adjust it to 0 if you want to turn off the illumination.

The changes you make are automatically saved.

5 Press the ▯ soft key to return to the previous menu screen.



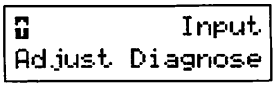
6 Press the Quit soft key again to terminate the adjustment.

5.2 Switching the ALC on/off

The Ambient Light Control (ALC) can automatically adjust PICTURE control, taking the ambient light intensity into account.

To switch ALC on or off:

1 From the main menu screen, press the ◘ soft key.



2 Press the Adjust soft key to enter the Adjust menu.

3 Press the ALC soft key.
The → indicator shows if ALC is currently switched on or off.

4 If you want to change the current selection, press the corresponding soft key.
The changes you make are automatically saved.

5 Press the ◘ soft key to return.

6 Press the Quit soft key again to terminate the adjustment.

The ALC is automatically switched off:

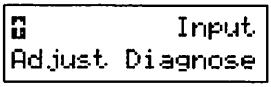
- at start-up
- when returning to the Reference position (REF key)
- when calibrating
- in case of 'Unsafe (light) output'. This means that the light output has reached the safety level for the picture tube. The display will automatically switch off ALC and reduce PICTURE and BACKGROUND controls.

5.3 Timing the demagnetization

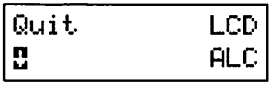
You can program the Reference Calibrator® to be demagnetized periodically, from 0 seconds to 12 hours.

If you set the period to 0, the display will only be demagnetized after power-on and after you have pressed the DEG (degauss) key on the front.

To set the period between two demagnetization actions:

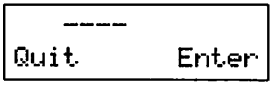


1 Enter the Adjust menu.



2 Enter the More Adjustments menu.

3 Enter the Demagnetizer menu.



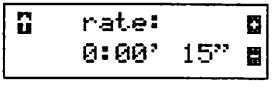
Press the REF key 4 times to enter the keycode.

4 Press the ◘ or ◘ soft key to set the period between two automatic demagnetization cycles.
This period is expressed in hours, minutes and seconds. Set the period to 0 in case you want to disable the periodic demagnetization.

The changes you make are automatically saved.

5 Press the ◘ soft key to return.

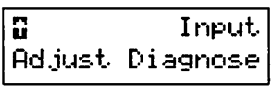
6 Quit the More Adjustments and Adjust menus.

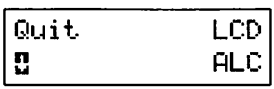


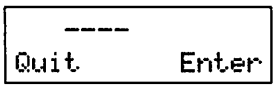
5.4 Setting the display address

When you make a chain of displays, all controlled by one single computer, you should assign a different address to each single display. The maximum number of displays you can assign, is 9.

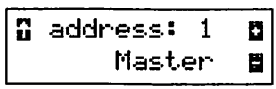
As a consequence the computer can control every display independently by sending the appropriate address.
The computer can alternatively control all the connected displays at the time by sending address 0, which is the 'General Call' address.







Press the REF key 4 times to enter the keycode.



The first display (connected to the computer) should get address no. 1.
This is the so-called Master display. It receives RS-232 or RS-422 signals from the computer and sends RS-485 signals to the next display. The others are so-called slaves. A slave receives RS-485 from the preceding display and equally sends RS-485 to the next one.

To set the display address:

1 Enter the Adjust menu.

2 Enter the More Adjustments menu.

3 Enter the Address menu.

4 Press the ◘ or ■ soft key to change the address.
The changes you make are automatically saved.

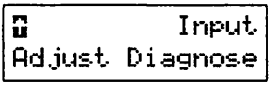
5 Press the ◘ soft key to return.

6 Quit the More Adjustments and Adjust menus.

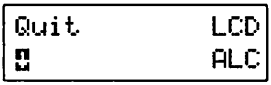
5.5 Setting the communication time-out

You can set the time the display's Remote port waits for communication with the computer before interrupting the communication. The minimum time is 10 seconds, the maximum is 10 minutes.

To set the communication time-out:

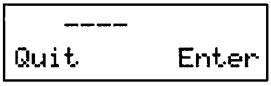


1 Enter the Adjust menu.



2 Enter the More Adjustments menu.

3 Enter the PC-timeout menu.



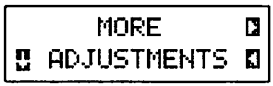
Press the REF key 4 times to enter the keycode.

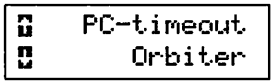
4 Press the ▲ or ▼ soft key to change the time-out, expressed in seconds.

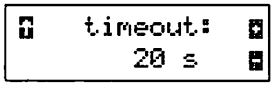
The changes you make are automatically saved.

5 Press the ▲ soft key to return.

6 Quit the More Adjustments and Adjust menus.



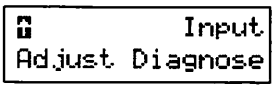


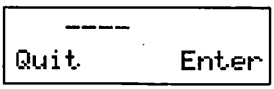


5.6 Switching Orbiter on/off

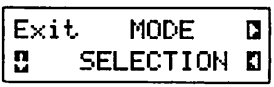
The Orbiter is an internal system that prevents burn-in of the picture tube by slightly moving the picture on the screen.

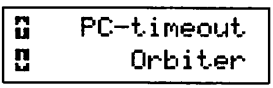
Especially for applications where a static picture is on the screen for a long time we recommend you turn the Orbiter on. It will save your picture tube.

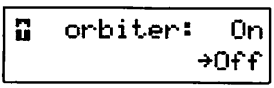




Press the REF key 4 times to enter the keycode.







To set the orbiter:

1 Enter the Adjust menu.

2 Enter the More Adjustments menu.

3 Enter the Orbiter menu.

4 If you want to change the current selection, press the corresponding soft key.

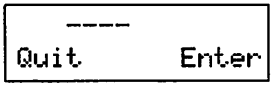
The changes you make are automatically saved.

5 Press the soft key to return.

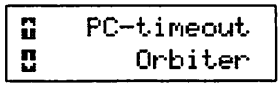
6 Quit the More Adjustments and Adjust menus.

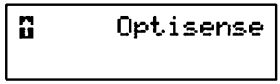
5.7 Reading Optisense® value

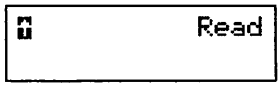
The Optisense® Read function returns a relative value for the light measured by the Optisense®. This function is meant for remote diagnosis in case you have problems with your display or with its calibration.

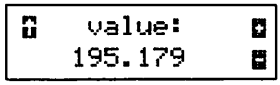


Press the REF key 4 times to enter the keycode.









You may need to communicate this Optisense® value in case of hotline support.

The Optisense® value differs from display to display and Optisense® head to Optisense® head.
Consequently two perfectly performing displays may return completely different values.

To read the Optisense® value:

1 Enter the `Adjust` menu.

2 Enter the `More Adjustments` menu.

3 Enter the `Optisense` menu.

4 Press the `Read` soft key. Don't forget to attach your Optisense® light probe.
The measurement might take a few minutes.

5 After the measurement the LCD displays the measured value.

6 Press any soft key to continue.

7 Quit the `More Adjustments` and `Adjust` menus.

6

MAINTENANCE

Calibration

The color temperature(s) you work with should be re-calibrated regularly. A reminder message will appear on the LCD display when it is time to re-calibrate.

Cleaning

Don't use chemical cleaning products, benzene, toluene, xylene or other solvents that might damage the plastics of the bezel and cover.

Clean the display with a soft cloth dampened with mild detergent and water, repeat this with water only and wipe with a dry cloth.

7

TROUBLESHOOTING

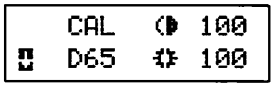
1. If the display doesn't operate at all, neither does the LCD:

- Check if the power plug is connected.
- Contact your local dealer for service.

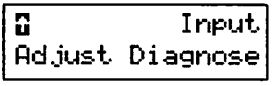
2. If there is a problem with the display, but the LCD still works:

- Contact your local dealer for service. Tell them what is written in the Diagnose menu.

To enter the Diagnose menu, proceed as follows:



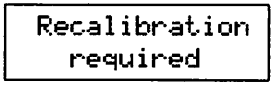
a) From the main menu screen, press the soft key.



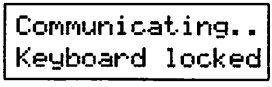
b) Press the Diagnose soft key to enter the Diagnose menu.

c) Press the soft key to scroll through the Diagnose menu.

3. If the display is operating but the LCD displays a warning, proceed as follows:

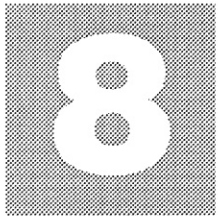


What you should do:
Calibrate the color temperature(s) you regularly use.



Adjust the display from the computer connected to the Remote in connector or terminate the computer session that occupies the display.

Reduce PICTURE and/or BACKGROUND controls to reduce the light output or press the REF key. You can alternatively wait until the display automatically reduces the PICTURE and/or BACKGROUND controls.



REFERENCE

How to use this chapter

The Reference chapter is meant for users who quickly want information about a particular function, key, or plug.

The information in this chapter is represented in a schematic way. Each item contains two parts: A header and a body.
The header supplies the following information:

Where to find this item on the display	Keycode protected, Yes or No	Brief explanation

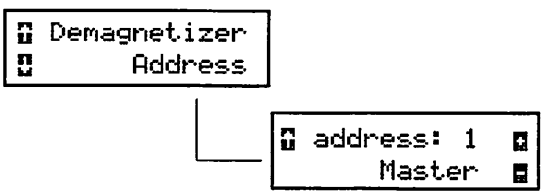
The body supplies the following information:

- All the LCD screens this item contains, in case of a menu item.
- Where you can find more information about this item in this manual.

Important: The items in this chapter are included in alphabetic order.

Address

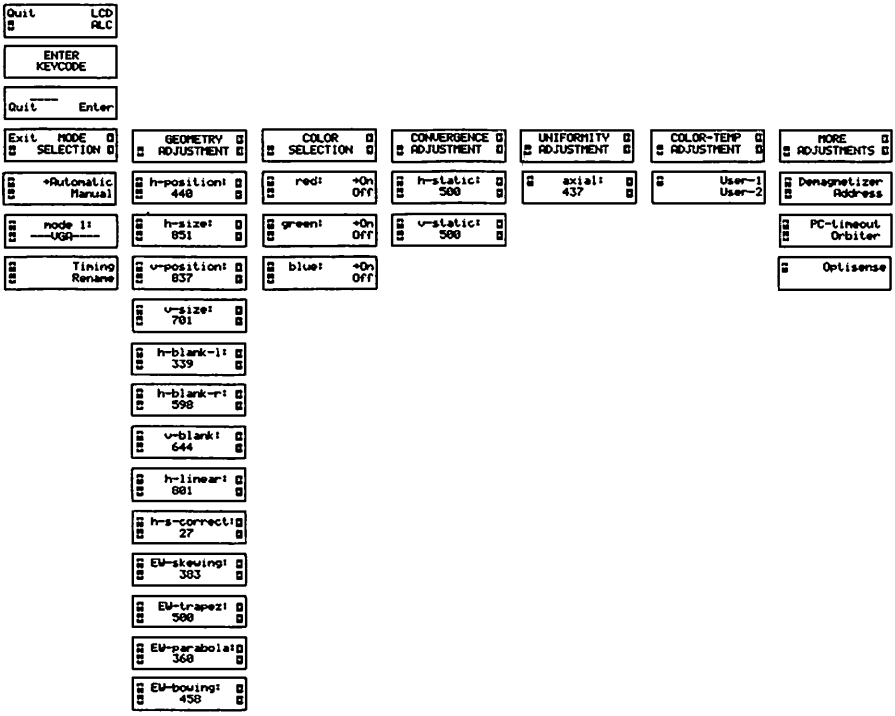
LCD display 1) Adjust 2) Adjust More	Yes	Set display address



See § 5.4 "Setting the display address".

Adjust

LCD display	Partly	Menu containing all adjustments

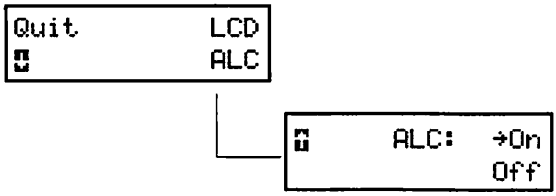


See Chapter 4 "How to adjust the Reference Calibrator®".
See also Chapter 5 "How to customize the Reference Calibrator®".

Adjust uniformity

See: "Uniformity"

ALC



LCD display 1) Adjust	No	Switch ALC on or off

See § 5.2 "Switching the ALC on/off".

AUX connector

Front panel	-	Input for Thoma® color analyzer

BNC inputs

Upper rear slot	-	Input for RGB analog signals and sync

See § 2.2 "Connecting the signals".

CAL key

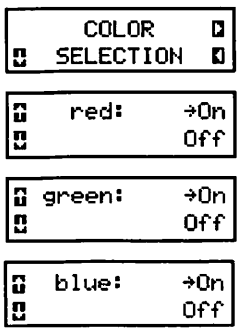
Front panel	No	Calibrate all or only 1 selected color temperature

See Chapter 3 "How to calibrate" .

Color Selection

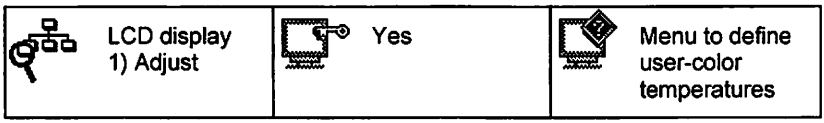
LCD display 1) Adjust	Yes	Menu to switch off one or two colors

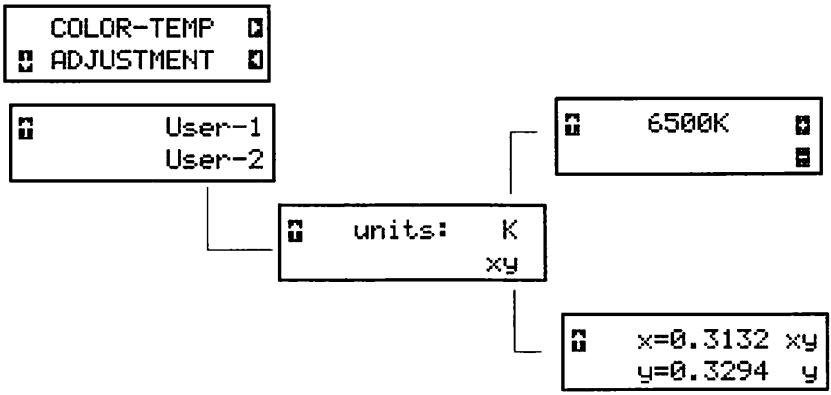
Menu to switch off one or two colors



See §4.3 "Color selection".

Color Temperature Adjustment





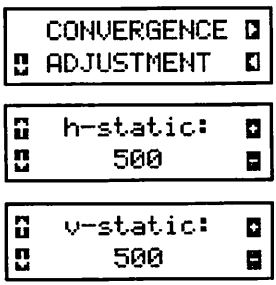
See § 4.6 "Color Temperature definition".

Color Temperature selection

See: "TEMP key"

Convergence Adjustment

LCD display 1) Adjust	Yes	Menu to adjust static convergence



See § 4.4 "Convergence Adjustments".

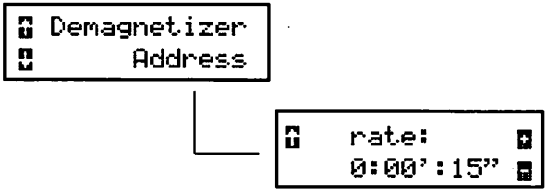
DEG key

Front panel	No	Immediately demagnetise the display

See § 2.8 "Demagnetizing the display" .

Demagnetizer

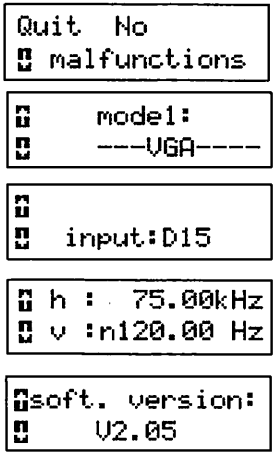
LCD display 1) Adjust 2) Adjust More	Yes	Set period of periodic demagnetization



See § 5.3 "Timing the demagnetization".

Diagnostics

LCD display	No	Clues in case of problems



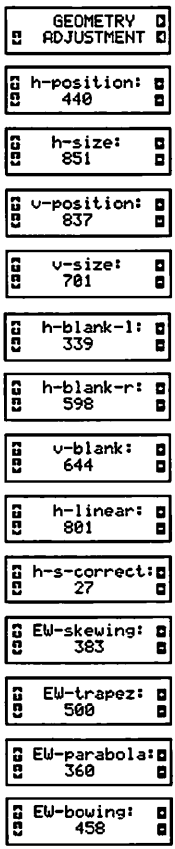
See Chapter 7 "Troubleshooting".

Enter keycode

See: "Keycode"

Geometry Adjustment

LCD display 1) Adjust	Yes	Menu with geometry adjustments



See § 4.2 "Geometry Adjustments".

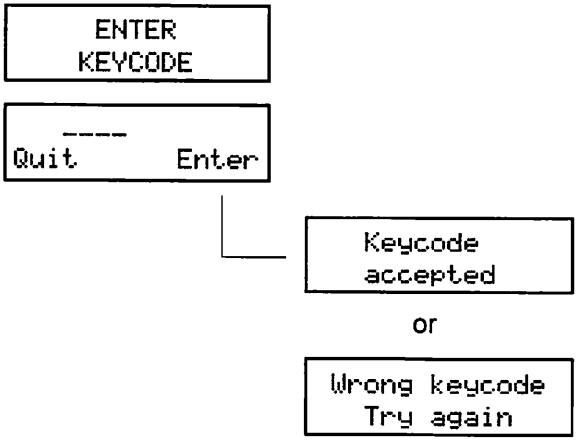
Input

LCD display	No	Manually select input

See § 2.4 "Selecting an input".

Keycode

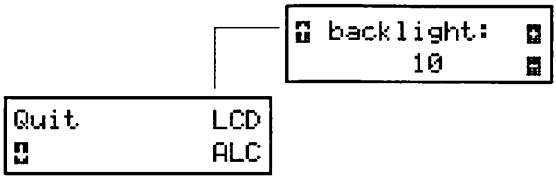
LCD display 1) Adjust	No	Enter keycode to get access to protected menus



See "Entering the Adjust menu" in Chapter 4 "How to adjust the Reference Calibrator®".

LCD

LCD display 1) Adjust	No	Set LCD illumination



See § 5.1 "Adjusting the LCD backlight" .

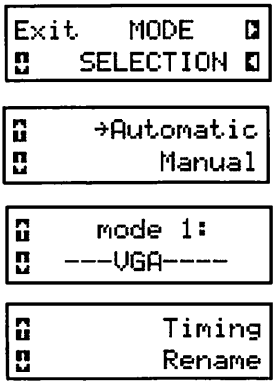
Mini D-sub 15 pins connector

Upper rear slot	-	Input for VGA signals

See § 2.2 "Connecting the signals".

Mode Selection

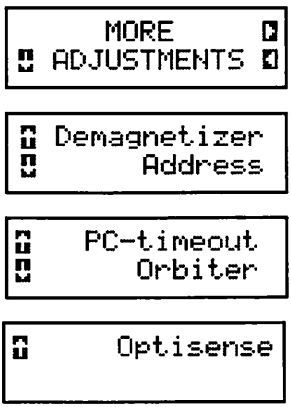
LCD display 1) Adjust	Yes	Menu for mode selection and definition



See § 4.1 “Mode selection”.

More Adjustments

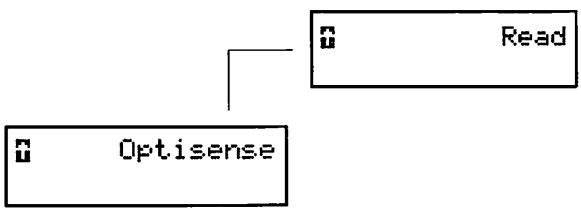
LCD display 1) Adjust	Yes	Menu with adjustments to customize display



See Chapter 5 "How to customize the Reference Calibrator®".

Optisense

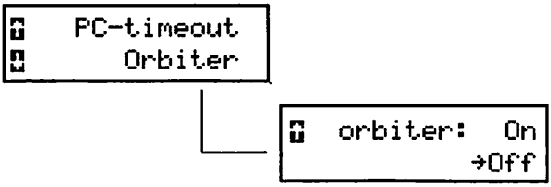
LCD display 1) Adjust 2) Adjust More	Yes	Read colour by Optisense® light probe



See § 5.7 "Reading a color by Optisense".

Orbiter

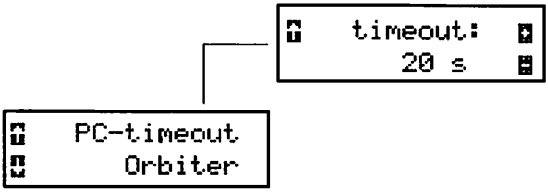
LCD display 1) Adjust 2)Adjust More	Yes	Switch orbiter on or off



See § 5.6 "Switching orbiter on/off".

PC-timeout

LCD display 1) Adjust 2) Adjust More	Yes	Set PC time-out



See § 5.5 "Setting the communication time-out".

REF key

Front panel	No	Return to Reference position

See § 2.7 "Return to reference picture".

Remote In connector

Lower rear slot	-	Input for computer communication

See § 2.2 "Connecting the signals".

Remote Out connector

Lower rear slot	-	Output for computer communication

See § 2.2 "Connecting the signals".

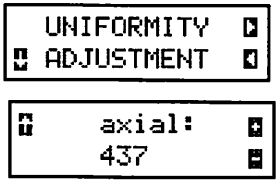
TEMP key

Front panel	No	Select color temperature

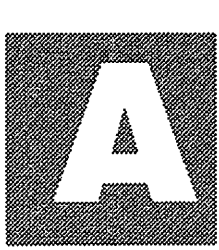
See § 2.5 "Selecting a color temperature".

Uniformity Adjustment

LCD display 1) Adjust	Yes	Adjust axial uniformity

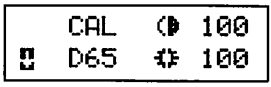


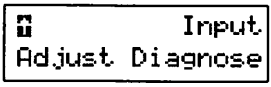
See § 4.5 "Axial uniformity adjustment".



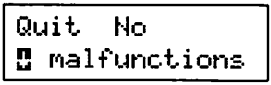
APPENDIX A: MENU STRUCTURE

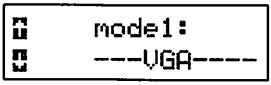
A.1 Main menus

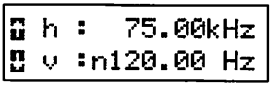


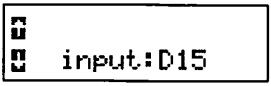


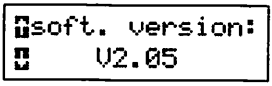
A.2 Diagnose menu





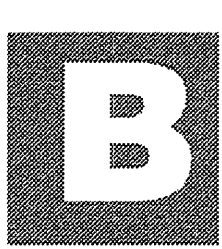






A.3 Input menu

A.4 Adjust menu



APPENDIX B:
LIST OF PRESET MODES

B.1 Reference Calibrator® 121

Preset mode	1	2	3	4	5
Resolution (HxV) Dot clock (MHz)	Apple 21" 1152x870 100.027	VGA mode 3 661x496 25.368	SGI 64 kHz 1280x1024 107.351	SUN 72 kHz 1152x900 105.561	SGI 77 kHz 1280x1024 130.000
Horizontal					
Frequency (kHz)	68.700	31.474	63.900	71.713	76.878
Total (µs)	14.556	31.773	15.650	13.945	13.008
Acitve (µs)	11.517	26.057	11.923	10.913	9.846
Blanking (µs)	3.039	5.716	3.726	3.031	3.162
Front porch (µs)	0.490	0.315	0.279	0.152	0.154
Sync (µs)	1.250	3.824	1.118	0.909	1.100
Back porch (µs)	1.300	1.577	2.329	1.970	1.908
Vertical					
Frequency (Hz)	75.000	59.950	60.000	76.050	72.25
Total (ms)	13.333	16.681	16.667	13.150	13.840
Acitve (ms)	12.664	15.759	16.025	12.550	13.320
Blanking (ms)	0.670	0.921	0.642	0.600	0.520
Front porch (ms)	0.044	0.064	0.047	0.028	0.039
Sync (ms)	0.044	0.064	0.047	0.112	0.039
Back porch (ms)	0.582	0.794	0.548	0.460	0.442
Scanning	Non-interlaced	Non-interlaced	Non-interlaced	Non-interlaced	Non-interlaced

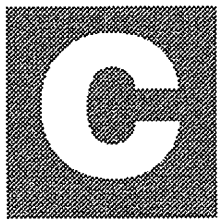
B.2 Reference Calibrator® 120T

Preset mode	1	2	3	4	5
Resolution (HxV) Dot clock (MHz)	Apple 19" 1024x768 79.998	VGA mode 3 661x496 25.368	SGI 64 kHz 1280x1024 107.351	SUN 72 kHz 1152x900 105.561	SGI 77 kHz 1280x1024 130.000
Horizontal					
Frequency (kHz)	60.240	31.474	63.900	71.713	76.878
Total (µs)	16.600	31.773	15.650	13.945	13.008
Acitve (µs)	12.800	26.057	11.923	10.913	9.846
Blanking (µs)	3.800	5.716	3.726	3.031	3.162
Front porch (µs)	1.000	0.315	0.279	0.152	0.154
Sync (µs)	1.000	3.824	1.118	0.909	1.100
Back porch (µs)	1.800	1.577	2.329	1.970	1.908
Vertical					
Frequency (Hz)	75.020	59.950	60.000	76.050	72.25
Total (ms)	13.330	16.681	16.667	13.150	13.840
Acitve (ms)	12.749	15.759	16.025	12.550	13.320
Blanking (ms)	0.581	0.921	0.642	0.600	0.520
Front porch (ms)	0.050	0.064	0.047	0.028	0.039
Sync (ms)	0.050	0.064	0.047	0.112	0.039
Back porch (ms)	0.481	0.794	0.548	0.460	0.442
Scanning	Non-interlaced	Non-interlaced	Non-interlaced	Non-interlaced	Non-interlaced

B.3 Reference Calibrator®

V9507302 (OEM product)

Preset mode	1	2
Resolution (HxV) Dot clock (MHz)	Prisma 1024x768 60.576	Savanna 1152x900 92.940
Horizontal		
Frequency (kHz)	48.000	61.800
Total (µs)	20.833	16.182
Acitve (µs)	16.904	12.395
Blanking (µs)	3.929	3.787
Front porch (µs)	0.264	0.344
Sync (µs)	1.832	1.377
Back porch (µs)	1.832	2.066
Vertical		
Frequency (Hz)	60.00	65.95
Total (ms)	16.667	15.163
Acitve (ms)	16.000	14.564
Blanking (ms)	0.667	0.599
Front porch (ms)	0.063	0.032
Sync (ms)	0.063	0.065
Back porch (ms)	0.542	0.502
Scanning	Non-interlaced	Non-interlaced



APPENDIX C: WHITE-POINT COORDINATES

First column: Correlated color temperature located on the Daylight locus.

Second column: Correlated color temperature; in Kelvin units.

Third column: x-coordinate.

Fourth column: y-coordinate.

D50	**5000**	**0.346**	**0.359**
D51	5100	0.343	0.356
D52	5200	0.340	0.354
D53	5300	0.338	0.352
D54	5400	0.335	0.350
D55	5500	0.333	0.348
D56	5600	0.330	0.346
D57	5700	0.328	0.344
D58	5800	0.326	0.342
D59	5900	0.324	0.340
D60	**6000**	**0.322**	**0.338**
D61	6100	0.320	0.336
D62	6200	0.318	0.334
D63	6300	0.316	0.333
D64	5400	0.314	0.331
D65	6500	0.313	0.329
D66	6600	0.311	0.328
D67	6700	0.310	0.326
D68	6800	0.308	0.325
D69	6900	0.307	0.323
D70	**7000**	**0.305**	**0.322**
D71	7100	0.304	0.320
D72	7200	0.303	0.319
D73	7300	0.302	0.318
D74	7400	0.300	0.316
D75	7500	0.299	0.315
D76	7600	0.298	0.314
D77	7700	0.297	0.313
D78	7800	0.296	0.312
D79	7900	0.295	0.310
D80	**8000**	**0.294**	**0.309**
D81	8100	0.293	0.308
D82	8200	0.292	0.307
D83	8300	0.291	0.306
D84	8400	0.290	0.305
D85	8500	0.289	0.304
D86	8600	0.288	0.303
D87	8700	0.288	0.302
D88	8800	0.287	0.301
D89	8900	0.286	0.300
D90	**9000**	**0.285**	**0.300**
D91	9100	0.285	0.299
D92	9200	0.285	0.299
D93	9300	0.283	0.297
D94	9400	0.283	0.297
D95	9500	0.282	0.296
D96	9600	0.282	0.296
D97	9700	0.281	0.294
D98	9800	0.281	0.294
D99	9900	0.279	0.293

BARCO

Calibrator® Talk

User Manual

Color Management Systems

This version of Calibrator®Talk supports the following Color Management Systems:

- Agfa FotoTune 1.xx
- Agfa FotoTune 2.xx
- Kodak KPCM (developer export version)
- ColorSync 2 (developer export version)

You can create a 'passport' of your Barco display to those CMSs by using the **Export** function in the File menu.
However you can also transfer your display data to other CMSs by entering the CCP parameters in the CMS. Please refer to Appendix D in this manual for more information.

Please refer to the ReadMe files on the CD-ROM for more information.

The Calibrator®Talk CD-ROM...

... is situated at the back of this manual.

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Calibrator®Talk

User Manual

V598691 October,1995

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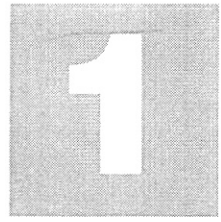
About this manual:

We apologize to users of Windows, SUN, or Silicon Graphics versions for the fact that all screendumps and illustrations in this manual were taken from Macintosh applications. This was done for practical reasons. We would like to thank you for your understanding.



INTRODUCTION

1.1 Welcome to Calibrator®Talk

Calibrator®Talk is a program that allows you to control the Barco Calibrator® through your computer. It enhances your viewing possibilities when using a color application and provides optimal conditions with respect to an accurate color reproduction.
Calibrator®Talk even offers you a high-precision color measurement tool for colors on the screen.

Calibrator®Talk allows you to:

CALIBRATE

- the display easily and accurately
- the combination graphics board - display

COMMUNICATE

- with Color Management Systems thanks to the Calibrator® Characteristic Parameters

MEASURE

- on - screen colors via the Optisense®

CONTROL

- PICTURE and BACKGROUND
- display gamma
- white point selection
- display geometry
- display purity

Note for SGI users: Gamma and Pick functions are not avaliable in the Calibrator®Talk version for Silicon Graphics.

Calibrator®Talk is now available for different computer systems:

Macintosh

SUN

MS Windows

Silicon Graphics

We are working on other versions..

1.2 What's included?

This Calibrator®Talk box contains the following items:

- two-ring binder
- registration cards for the US, Japan, Far East and the rest of the world
- 'short' installation card
- control cable
- software on CD
- user manual

1.3 What's new?

Version 4.01 compared to 3.2:

- Support for different Color Management Systems.
- Color measurement.
- Ambient Light Control in the main window.
- Guided installation procedure to install a new graphics board.
- New menu items: Select (Monitor Setup) and Preferences.

Version 4.02 compared to 4.01:

- Luminance Uniformity Correction for Barco Mega Calibrator® displays.
- Color picker for convenient color measurement.
- Extended re-calibration, every tenth time.

Version 4.03 compared to 4.02:

- Possibility to remove stored monitor setups.
- Sound on / off.

INSTALLATION

2.1 Hardware installation

To connect display to computer:

1. Switch off your computer, monitor, and connected peripheral equipment.
2. Connect the *video output* of the computer's graphics board to the monitor *video input* by means of an appropriate video cable.
   Refer to Appendix B for the list and order numbers of available video cables at Barco.
3. Connect the computer *serial port* (COM-port for PC and Modem port for Mac) to the monitor *Remote In* by means of the supplied control cable.
4. Switch on peripheral equipment, monitor, and computer.

For more information, refer to the monitor's User Manual.

2.2 Macintosh version installation

Recommended hardware

- Barco color display.
- Macintosh II or higher.
- CD-ROM reader.
- 1 Mbyte of free disk space at least.
- "True color" type graphics board, 24-bit color with LUT access to have full Calibrator®Talk possibilities.

Required software

- System 6.07 or higher.

Remark: Calibrator®Talk is System 7 compatible.

Software installation

Before installation:

- Be sure to disable all virus protection software. Remember to enable it again after installation.
- Restart your Macintosh, holding down the SHIFT key. In that case, the message **Extensions off** appears.

To install:

1. Insert the Calibrator®Talk CD-ROM in the reader.
2. Double-click the CD-ROM icon.
3. Double-click the **MAC** folder.
4. Double-click the **Calibrator®Talk4.03** folder.
5. Double-click the **Calibrator®TalkInstall** icon.

Figure 2.1

The Easy Install window appears.

It indicates the files that the Installation program will copy to your disk. It additionally indicates the name of the disk or partition where it will copy those files.

6. Click:
   - **Install** to start the installation.
   - **Switch disk** to select another disk or partition.
   - **Customize** to manually select the files to be installed.
   - **Help** to get help on the Installation window.
   - **Quit** to stop the installation.
7. If you have selected **Install**, the installation begins.
   During installation you can click **Cancel** to abort the installation. In that case the Installation program will copy nothing to your disk.

   The Installation program copies the selected files to your selected disk or partition.

Remark: The Installation program also copies the file **Calibrator®Talk INIT** into a system folder on the selected disk or partition. If this is not the partition that contains the System folder (System 6) or System Extensions folder (System 7), you should copy the **Calibrator®Talk INIT** file to your System (Extensions) folder after completing the installation.

8. After successful installation, remove the CD-ROM. Enable your virus protection software again.

After having completed the setup, you can immediately start Calibrator®Talk by double-clicking its icon. But please first read chapter "Getting started".

2.3 Windows version installation

Recommended hardware

- Barco color display.
- IBM Personal Computer or compatible, model 386 or higher.
- CD-ROM reader.
- 1 Mb of free disk space at least.
- "True color" type graphics board, 24-bit color with LUT access to have full Calibrator®Talk possibilities.

Refer to Appendix C for a list of tested boards that support full Gamma and Calibration control.

Required software

- Microsoft Windows version 3.1 or higher.

Software installation

To install:

1. Start Windows.
2. Insert the Calibrator®Talk CD-ROM in the reader.
3. Open Windows File Manager and select **Run**.
   The File Manager now asks you to enter a file path and name.
4. Enter path and name of the setup program, e.g.,
   D:\CALITALK\WIN\SETUP.EXE (in case D: is the CD-ROM reader drive),
   and click **OK**.

The Setup window appears. Follow the guidelines in the window to proceed.

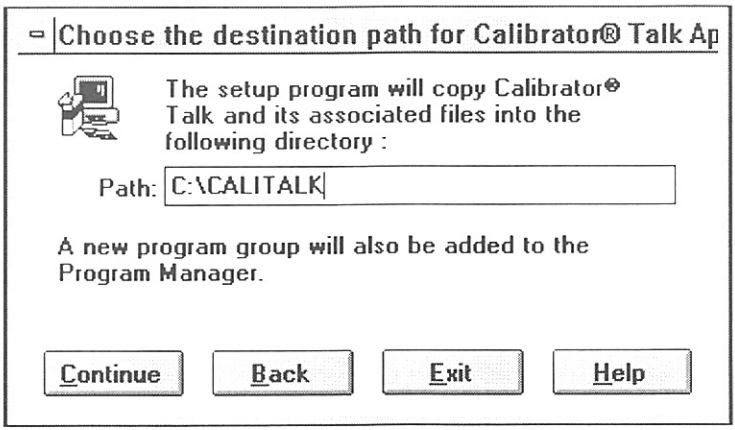


Figure 2.2

- Click **Continue** to proceed with the installation.
- Click **Back** to return one step and change settings.
- Click **Help** to get information on the setup program.
- Click **Exit** to abort the installation.

After having completed the setup, you can immediately start Calibrator®Talk.

2.4 SUN version installation

Required Hardware & software

Hardware: SUN Sparc station 10 or Sparc station 20.
A 24-bit color graphics board.
CD-ROM reader.

Operating system: Solaris 2.3, English version.

Installation via File-Manager

1. Insert the CD-ROM in the reader.
   Since there is an Automatic Volume Mounter in Solaris 2.3, the CD-ROM will automatically be mounted and available in the directory */cdrom/cdrom0*.
2. Start up file-manager.
3. Start the script file "install.cal" in the /calitalk/sun on the CD-ROM.
4. To start Calibrator®Talk, double-click the CALITALK icon under the calitalk subdirectory in your home directory.

Installation without File-Manager

1. Insert the CD-ROM in the reader.
   Since there is an Automatic Volume Mounter in Solaris 2.3, the CD-ROM will automatically be mounted and available in the directory */cdrom/cdrom0*.
2. Type:
   volcheck
   /cdrom/cdrom0/calitalk/sun/install.cal
3. To start Calibrator®Talk, type:
   cd ~/calitalk
   calitalk

In case of problems

In case the above does not work, it means you cannot access the CD-ROM. Check whether the Automatic Volume Mounter is running: Type the command *ps -e | grep vold*

The result of this command should be a line including the word "vold". If not, the vold (Volume Mounter) is not running.

1. The Automatic Volume Mounter is not running.

In that case you can either start it or mount the CD-ROM yourself. For both actions you need to be Super-user (root).

- Login as Super-user.
- To start the Automatic Volume Mounter, type the command */usr/bin/vold*
- To mount the CD-ROM, type the command

mount /dev/rdf0c /cdrom/cdrom0

Now you should be able to continue with the installation procedure as described above.

2. The Automatic Volume Mounter was already running.

If the Automatic Volume Mounter was already running, but you still cannot access the CD-ROM, contact your System-Administrator to have things checked out.

24-bit Colormap behavior

Since most video cards can only display one 24-bit colormap at the same time, the Window Manager default switches between different colormaps depending on the window on which the mouse-pointer cursor is located. Since this is normally not what you want when using Calibrator®Talk, you can lock a 24-bit colormap.

Locking the Colormap

Press: CTRL-Again

This locks the 24-bit colormap of the window on which the mouse-pointer is situated. It means the Window Manager will not install another colormap, even if your mouse-pointer is above a window with another 24-bit colormap then the one currently locked.

Unlocking the colormap

Press: CTRL-Undo

This unlocks the 24-bit colormap. From this moment the Window Manager will again dynamically install the colormap of the window on which the mouse-pointer is situated.

Preferred method when using Calibrator®Talk

If Calibrator®Talk is running, there is a 24-bit Calibrator®Talk window available.

Position your mouse-pointer above this window and press the CTRL-Again keys. This locks the 24-bit colormap of Calibrator®Talk and you will immediately see all the changes you make in Calibrator®Talk.

For the latest information please read the "README" file.

2.5 SGI version installation

System requirements

- Hardware: Calibrator®Talk is fully tested on Indy and Indigo² workstations. Please contact your Barco dealer if you want to run the software on another type of workstation.
- Operating System: Calibrator®Talk requires IRIX 5.2 at least.
- Barco display software (firmware): version 2.06 at least for Reference Calibrator®.

Installation from CD-ROM

1 Type in a UNIX shell:
cd /cdrom/calibratortalk/sgi/calibratortalk403/installtalk
2 Read the **readme** file for further information.

Installation from tape

1 Open a UNIX shell.
2 Load the tape in the drive.
3 Change to your home directory (**cd~**).
4 Enter command **tar xv**.
This will create the subdirectory calibratortalkxx.
5 Change to directory calibratortalk.
6 Read the file **readme** for further instructions.

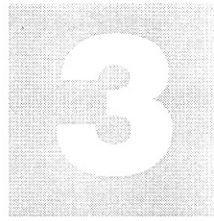
Port selection

During installation, you can select port A (ttyd1) or port B (ttyd2) to communicate with the Calibrator®. Make sure that the port you use is available. Also refer to the on-line Help file.

You can check this by selecting the system from the Desk.

1 Select system manager
2 Double-click the *Port Setup* icon.
You can make a port available (if it is not) by selecting the port and clicking the *Disconnect* button.
3 Close the Port Setup and leave the system manager.

If you receive an error message BUILDCOMMDCB error when starting up Calibrator®Talk, you must change the access privileges of the serial port, either by using Port Setup from the desktop system manager tool, or by entering the following UNIX command:
chmod 777 /dev/ttyd1 if you are using port A or
chmod 777 /dev/ttyd2 if you are using port B.



GETTING STARTED

3.1 Graphics board settings

A number of Calibrator®Talk functions only operate when you are working with a 24-bit 'True Color' graphics board.

(Only on Macintosh) Be sure to configure your graphics board in 24-bit mode. Therefore select Millions of colors in the Monitors control panel.

3.2 Disable software that resets gamma

Your computer might contain applications or software that sets your graphics board's gamma to a certain value. E. g., the Gamma application in the Macintosh control panels is such a program.

You should disable this kind of application before running Calibrator®Talk. If not, your Gamma setting will be determined by the other application, not by Calibrator®Talk. The application can reset gamma to another value without your knowledge, resulting in strange, unexpected print-out results.

You will probably find Gamma applications in the computer's system control panel(s) or in the application's Preferences.

3.3 Starting Calibrator®Talk

The program can only start under the following conditions:

- The display's Remote In is connected to the correct serial port.
- The address of the connected display is #1, unless you specified another address during installation.
- The display LCD is placed in the main menu.

Run the Calibrator®Talk program. The initialization of the software begins.

This might take some time, depending on the type of computer you are working with.
During initialization, Calibrator®Talk reads the program preferences, checks the monitor type it is connected to, loads the monitor settings, and looks for possible plug-ins.

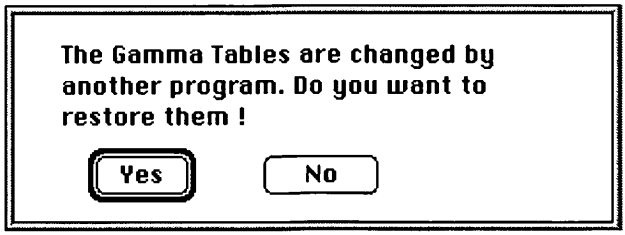


Figure 3.1

After initialization, Calibrator®Talk may display the following message:
In most cases, this means that another program has changed the gamma set by Calibrator®Talk. If you select **Yes**, Calibrator®Talk changes the gamma again and starts with its last saved setting.
If you select **No**, Calibrator®Talk accepts the values from the graphics board's Look Up Table. It will start with "Arbitrary Gamma".

This messsage appears:

- When you start Calibrator®Talk for the very first time.
  In this case, we advise you to select **No**. Your screen will remain unchanged.
- When you connect your computer to another display.
  In this case, we advise you to select **Yes**.
- When your gamma setting was changed by another application.
  In this case, we advise you to select **No** in case you really want to accept the change, made by the other application. Otherwise, select **Yes**.

Remark: Calibrator®Talk will only run if you have an operating Barco Calibrator® type display connected to your computer.

After initialization the Calibrator®Talk main window appears.

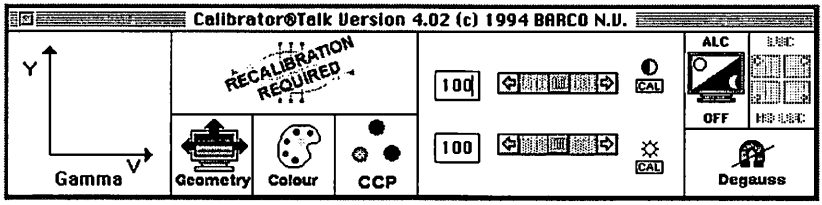


Figure 3.2

In the main window you see if the display needs to be re-calibrated. You will additionally find a number of Calibrator® functions which are directly accessible. These functions are the PICTURE-setting, the BACKGROUND-setting, Degauss, and Ambient Light Control. Only for Mega Calibrator® displays, you additionally find the Luminance Uniformity Correction (LUC). In the different subwindows you find more advanced functions: Gamma control, Geometry adjustment, Color control, and CCP information.

3.4 Selecting graphics board

(Macintosh only)

Should your computer contain more than one graphics board to which a monitor is connected, it is very important to tell Calibrator®Talk to which board the Reference Calibrator® or MegaCalibrator® is connected. Should you select the wrong board, Calibrator®Talk will not be able to control your Barco display.

To select the graphics board:

1. Select **Preferences** from the **File** menu.
2. Select **Graphic Boards...** .

   The Graphic Boards window appears. It is similar to the Macintosh **Monitors** control panel.

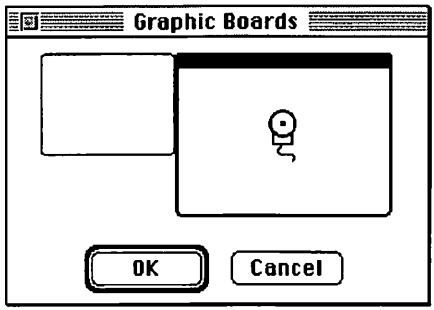


Figure 3.3

The rectangular icons in the window represent the monitors connected to the different graphics boards in your computer. They are drawn in proportion to their resolution.

One of them is highlighted and contains the drawing of an Optisense® device. This represents the display you are currently controlling.

3. Click the icon representing your Barco Calibrator® to select it.
4. Click **OK** to confirm.

   Now all the Calibrator®Talk windows will position themselves on the selected display.

Remark: The Graphic Boards window differs from the Macintosh **Monitors** control panel in the following points:

- The menu bar will not reposition itself to the selected screen.
- You need not reboot the computer before the changes take effect.

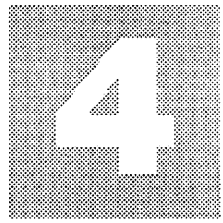
3.5 Getting help

Calibrator®Talk contains on-line help.

In the MS-Windows version you will find the Help utility in the menu bar. You can additionally get help on any item in the program by pressing the **F1** key on your keyboard.

In the Macintosh version you can get Help by pressing the ***help*** key on the Extended Keyboard or by pressing the **option -?** keys.

In the SUN and SGI versions, you find Help in the menu bar.



USING CALIBRATOR®TALK

4.1 The Calibrator®Talk functions

PICTURE and BACKGROUND

PICTURE control adjusts the contrast of the image on the screen.
BACKGROUND adjusts the brightness of the image on the screen.

To adjust PICTURE and BACKGROUND:

- Drag the sliders.
  Drag them to the left to decrease the level, and to the right to increase it.
  The number in the text box at the left side of each slider bar represents the PICTURE or BACKGROUND value. A value of 100 corresponds to calibrated position.
- OR click the arrows at the left or right of each slider bar.
  In this way you adjust PICTURE and BACKGROUND in steps of 1.
- OR Click inside the slider bars, left or right of the sliders.
  In this way you adjust PICTURE and BACKGROUND in steps of 15.
- OR enter a number in the PICTURE or BACKGROUND text box.

To set PICTURE and BACKGROUND in calibrated position:
Click **CAL** at the right of the slider bars.

Tip: It is best to put PICTURE and BACKGROUND in calibrated position when color accuracy is important, as the colors on your screen are only truly calibrated when PICTURE and BACKGROUND are in calibrated position.
Therefore always keep them in calibrated position when you are working with a Color Management System.

Every change you make in Calibrator ®Talk will affect the settings for PICTURE and BACKGROUND in the display itself.

The PICTURE and BACKGROUND settings are automatically stored after every change. This means that Calibrator ®Talk starts with the settings from the previous Calibrator®Talk session.

Ambient Light Control

Ambient Light Control is often shortened to ALC.
The Reference Calibrator® and MegaCalibrator® displays are standard equipped with an ALC circuit. For Calibrator® and Calibrator® II it is an option.

Imagine a color display operating in an illuminated room. The display picture tube emits light of a certain intensity . Now dim the light in the room and look at the picture tube again. Now it seems to be much brighter, although the intensity of the emitted light hasn't changed.
The consequence of this small experiment is, that we can decrease the intensity of the image in dim ambient conditions and still keep the same impression of intensity. This is automatically accomplished by the ALC system.

The ALC system measures the ambient light in the room by means of a light-sensitive device at the front of the display. It is placed in the local control keyboard in Reference Calibrator® and MegaCalibrator® displays, or in the bezel in Calibrator® displays. The measured light is then recalculated in the display. As a consequence the ALC system automatically adjusts PICTURE and BACKGROUND, taking the ambient light around the display into account.

To switch on/off the ALC system:

1. Look in the **ALC** box in the main window: It indicates whether ALC is on or off.
2. Click inside the **ALC** box to switch the ALC status.

The change immediately takes effect.

Tip: Whenever you need accurate, truly calibrated colors, switch off Ambient Light Control. So when you are working under a Color Management System, ALC must be switched off.
The reason is that you should work in a calibrated, controlled environment when you require high color fidelity.

The setting of ALC is automatically saved after changing it. So Calibrator®Talk starts with the previously saved setting.

Luminance Uniformity Correction (LUC)

Luminance Uniformity Correction (LUC) is only available for MegaCalibrator® displays. The function in the main window is grayed when Calibrator®Talk communicates with other display versions.

The MegaCalibrator® is equipped with a very large high-resolution picture tube. Such a picture tube normally has a substantial loss of light intensity at the edges. This results in a poor uniformity and relatively big color errors at the edges.
LUC is a system that increases the luminance at the edges of the tube to create a uniform luminance over the whole screen, resulting in completely calibrated images.

To switch on/off the LUC system:

1. Look in the **LUC** box in the main window: It indicates whether LUC is on or off (when the text in the box is "OFF", LUC is off).
2. Click inside the **LUC** box to switch the LUC status.

The change immediately takes effect.

In case you wish to work with LUC switched on, you have to re-calibrate the LUC system to obtain optimum results. For more information, refer to § "Re-calibrating LUC" in this chapter.

It is impossible to activate ALC and LUC at the same time. When one of both is on, the other is disabled. At the same time, PICTURE and BACKGROUND controls are also disabled.

Selecting another white-point

The Reference Calibrator® and MegaCalibrator® displays have five pre-defined white-points.
Three of them are factory-defined; the two others are user-defined.
The factory-defined color temperatures are:
5300 K, 6500 K, 9300 K.

Remember: The lower the white point, the more reddish your image looks.

To select another white-point:

1. Open the **Color** window in Calibrator®Talk.
   The current white-point is indicated in a box in the top of the window.
2. Click the down arrow at the right of the white-point box.
   The box opens and shows the five white-point possibilities.
3. Select one of the white-points from the box.
   The monitor immediately sets to the new white-point.
4. Close the **Color** window again.

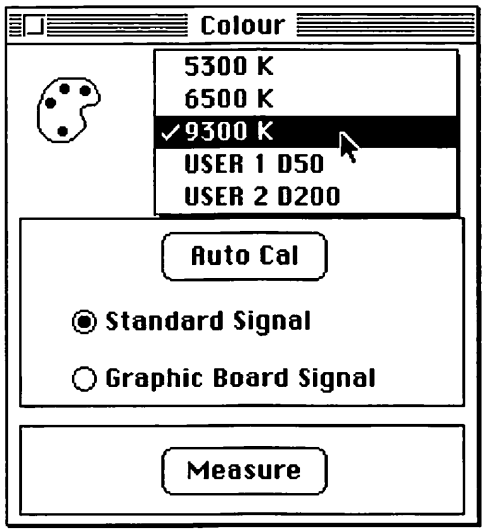


Figure 4.1

Tip: The selection of the appropriate white-point depends on your application.

- When you judge printed images under a standard light source like a viewing booth, select the same white point on your monitor as the color temperature of the light source.
- D50 and 5300 K are most often used in graphics and pre-press industry because they use this value of light source to illuminate their work.
- 6500 K is also used in graphics industry, in textile design industry and other applications where the work needs to be looked at under neutral daylight.
  6500 K is also used for Kodak PhotoCD and video images.

- 9300 K is used in applications that require high contrast and highly detailed images, like Computer Aided Design.
- When you feel unsure about selecting a white-point, select 6500 K. This is the most 'neutral' white-point.

For more information about white-points and color temperatures, refer to Appendix A: About Color.

Measuring on-screen colors

When you position your Optisense® on a uniformly colored surface on your screen, Calibrator®Talk can measure the components of that color, i.e. the amount of red, green, and blue in that color, *as it is displayed on-screen*. It then calculates these into the parameters of a certain color space. Therefore you need to activate the "Measure" utility in the Color window.

You can define the color in the following color spaces: CIE-XYZ, xyY, L*u*v*, or L*a*b*. The color space you select depends on the type of application you are working in. You can additionally recall the color values of the current white-point by selecting the **Reference White** option.
Particularly when you wish to recalculate a color from XYZ to L*a*b*, you need the (X,Y,Z) coordinates of the reference white.

However, there are a few restrictions:
- your computer must be equipped with a 24-bit, 'True Color' graphics board
- the color you want to measure must uniformly cover a surface of at least 50 mm by 50 mm or 2-inch by 2-inch. Use the color picker tool to fill the whole screen with the color to be measured.

To measure an on-screen color:

1. Open the **Color** window in Calibrator®Talk.

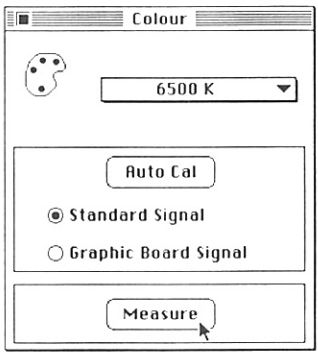


Figure 4.2

2. Click the **Measure** button.
   The Measure window appears. In the top of the window you can select the color space in which to measure.

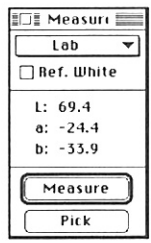


Figure 4.3

3. Select the color space.
4. Click the **Pick** button to select a color.The cursor becomes a pipette.
5. Position the pipette on an element on your screen that bears the color you want to measure, and click. The selected color fills the screen.
6. Position the Optisense® on the color.
7. Click **Measure** to start measuring.
   Now Calibrator®Talk begins to measure through the Optisense®, taking the display's CCPs (Calibrator® Characteristic Parameters) into account. After having completed the measurement, Calibrator ®Talk displays the measured color components, corresponding to the selected color space. A built-in color space calculator can automatically recalculate the measured values into any of the other three color spaces.
   A sound indicates the end of the measurement.
8. Select **Undo Pick** and close the **Measure** window.

Tip: The accuracy of the measurement improves when the display has been recently re-calibrated.

Remarks:

- The color Pick tool is not available on Silicon Graphics platform.
- Should you perform color measurement on a computer that contains more than one graphics board, first select the board your Barco Calibrator ® display is connected to. You can do this by means of the **Graphic Board...** option in the **File-Preferences** menu.
- We recommend to let the Optisense ® warm up for fifteen minutes before you actually start the calibration or measurement.
- For precise adjustments and measurement, we recommend to cover (the picture tube of) your Calibrator® during the calibration or measurement by means of your Ambient Light Shield.

The relationship between the measured values and color definition in the application

In some software applications you can define colors in the same CIE color spaces as those in which you can measure in Calibrator® Talk. Although the color measurement in Calibrator®Talk is very accurate with respect to the CIE standards, you may notice differences between the measured values of a certain color and the original definition of the same color in the application.
The reason for this can usually be found in the accuracy of the information about the color display, supplied to the application: For high color accuracy, the software needs to know the exact and unique parameters that define the display's color behavior. But in many cases, the software only gets so-called generic *or average parameters. They are average and should count for every display of the same type. As a consequence, they can never be really exact for any particular display. This results in a difference between the color values calculated by the application, and the measured values of the same color, measured by Calibrator®Talk. You can minimize these differences by:*

• using individual parameters instead of generic parameters. You can find these in Calibrator®Talk's CCP window. Fill them out in the application's monitor preferences, if possible
• exporting the CCP parameters from Calibrator®Talk to the Color Management System, if present
• measuring while your display is in calibrated position
• re-calibrating your display with the ***Graphic Board Signal*** *option*

For more information about the communication between Calibrator®Talk and other software, refer to "Using Calibrator®Talk in combination with other software".

Setting the display Gamma

The gamma is a characteristic of each color-handling device. It is a number that indicates the relationship between the color values at the input and those at the output. A graphics board has a gamma, determined by the LUTs, but also a color display has a gamma.

A color display in fact has three different gamma values: One for the Red channel, one for Green, and one for Blue. As a general rule we can say: The higher the gammas of the monitor, the darker the images are on the screen.

The gamma numbers in Calibrator ®Talk represent overall gamma, i.e., the product of your monitor gamma and the values in your graphics board's Look Up Table.
The monitor gammas are fixed, and can be seen in Calibrator ®Talk's CCP window. So when you change the Gamma numbers in Calibrator ®Talk, the software recalculates and changes the values in the graphics board's Look Up Table.
For more information on gamma and Look Up Tables, refer to Appendix A: About Color.

On Silicon Graphics

On Silicon Graphics platform, Calibrator ®Talk doesn't contain the Gamma function, and this for the following reason: On SGI you are working in a so-called *Motif* environment. In such an environment, each window on the screen can have its own Color Table. In addition each window is influenced by the system Gamma.
The system Gamma can be set by the System Manager. During start-up, this system Gamma is initiated to be the initial Gamma for every window you open. Some programs, e.g., Adobe Photoshop, alter their window's initial Gamma value to a value that is defined in its preferences. The Gamma in such a window is thus influenced by the system Gamma, as well as the application or window Gamma.

What can you do?

In general, you can have the Gamma of your system changed by the System Manager. E.g., he can enter the command "gamma 2.2" in the root to set the system Gamma to 2.2.
When you wish to do an external re-calibration from Calibrator®Talk, you have to set the system Gamma to 1. Again, ask the System Manager of your system to do so (you need the system password to do so).

On other platforms

To set Gamma:

1. Open the **Gamma** window in Calibrator®Talk.
   The Gamma window opens with the last saved gamma setting, unless you answered "No" at the message "The Gamma Tables are changed by another program..." during startup. If so the Gamma window opens with Arbitrary Correction.
   The three curves in the window indicate the current gamma functions for the three colors: Red, Green, and Blue. The current gamma number is written in the boxes below the curves.
   The name of the current gamma correction is written in the Gamma correction box.
   A gray-scale pattern indicates the effect of the gamma setting.

2. Click the down arrow next to the Gamma correction box.

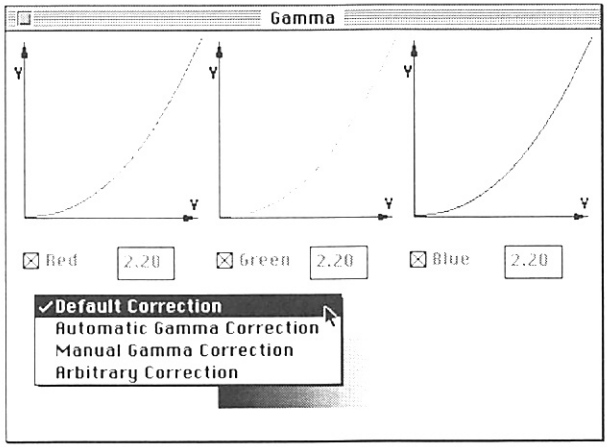


Figure 4.4

The box opens and shows the four gamma correction possibilities:

- Default correction, corresponding to the parameters of your monitor.
- Automatic correction, taking different ambient conditions into account.
- Manual correction, allowing you to enter any number between 0.1 and 10.
- Arbitrary correction, allowing you to enter any possible gamma curve.

3. Select a gamma correction from the list.
4. Specify the gamma number or gamma function, if necessary (see below). The monitor immediately sets to the new gamma setting.
5. Close the **Gamma** window.

Tip: The gamma number you set in Calibrator·Talk depends on the application. Please refer to the chapter "Using Calibrator·Talk in combination with other software" for some practical examples.

If the application or Color Management System requires a particular gamma setting, set gamma in Calibrator·Talk according to their requirements. If you don't do that, your printed results may look quite different from the image on your screen. You can find the application's gamma requirements in its documentation.

If you feel unsure about how to set the gamma, select "Default correction".

You can additionally select Average Gamma. In this case Calibrator·Talk calculates the average between the three gamma values (Red, Green, and Blue) of your display. We advise you to do this if you get undesired color effects in the gray scales, due to resolution problems in your graphics board's Look Up Table.

Default Correction

You can't set a specific gamma number here.
Calibrator·Talk selects a default gamma value for the three colors, according to your monitor.

Automatic Correction

Calibrator·Talk calculates a gamma number, taking the human eye behavior for different surround conditions into account.
"Surround" refers to the border around the images on your screen or to the background of your monitor in the room you are working.

To select a surround condition:

1. Click the down arrow at the right of the **Surround** box.
The box opens, showing the four possible surround conditions.
- Light Surround corresponds to a gamma of 1
- Dimmed Surround 1 corresponds to a gamma of 1.15
- Dimmed Surround 2 corresponds to a gamma of 1.25
- Dark Surround corresponds to a gamma of 1.5

2. Select the surround condition according to your working environment.

Manual Gamma Correction

Here you can enter a gamma number between 0.1 and 10 for the three colors.
There are boxes next to the three colors Red, Green, and Blue. When they are selected, the corresponding colors will have the same gamma value.

To select Manual Gamma:

1. Select the boxes of the colors you want to give the same gamma value.
2. Click in the text box(es) of the gamma value(s) you want to change.
3. Change the gamma value(s).

Arbitrary Correction

Here you can enter any gamma curve for the three colors. You can manually enter a function or load an arbitrary gamma function from a text file on disk. You can additionally store your arbitrary gamma function as a text file on disk. You can import and edit this file in a wordprocessor or spreadsheet program.

Again there are boxes next to the colors to link two or all three colors. The colors that are linked always have the same gamma function.

The Gamma window now shows three tables with text boxes below. The first column of the tables indicates the values on the V-axis of the corresponding gamma curve.
The second column indicates the values on the Y-axis, corresponding to the values on the V-axis.

To manually enter an arbitrary function:

1. Select the boxes of the colors you want to give the same gamma curve.
2. Double-click the value from the table you want to change.
   This value appears in the corresponding text box below.
3. Change the value in the text box.
4. Press **ENTER** on your keyboard.
   The new value appears in the table(s). The depicted gamma curves also show the change.
5. Continue until you have entered the complete function.

To load an arbitrary gamma function from disk:

1. Enter the arbitrary gamma function in a text file.
   E.g., create an MS-Excel file with 3 columns of 255 entries. The first column contains the values for Red, the second column for Green, and the last one for Blue. Save the file as **Text** format.
2. Select **Load Gamma...** from the **File** menu.
   The load window appears. Calibrator·Talk shows a list of available text files.
3. Pick the appropriate file from the list.
4. Click **Open** to load the gamma text file.

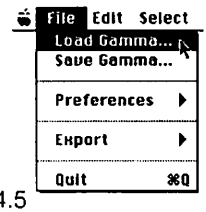


Figure 4.5

To store an arbitrary gamma function on disk:

1. Enter the arbitrary gamma function (see above).
2. Select **Save Gamma...** from the **File** menu.
   The save window appears. Calibrator·Talk suggests a default name and place to store the gamma text file.
3. Change the file name and the place where to store it, if necessary.
4. Click **Save** to save the gamma text file.

Figure 4.6

Adjusting Geometry temporarily

The geometry window allows you to make small and temporary changes to your picture's geometry.

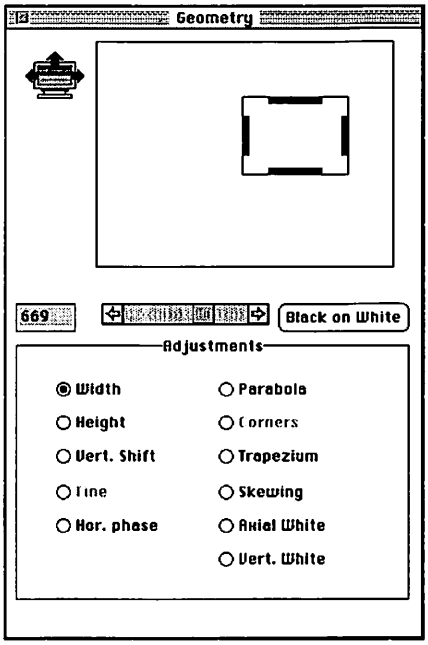
When you open the Geometry window, Calibrator·Talk displays the following message: "Do you want to install new geometry settings and store them in a setup?" Select **Yes** in case you wish to save the changes you make. In that case the Monitor Setup window appears instead of the Geometry window. Select **No** in case you don't wish to save the changes. In that case, the changes will be lost at the time you switch off your display.

For your help the monitor displays a crosshatch pattern as long as the geometry window is open. The pattern is normally made of white lines on a black background. For uniformity adjustments you can reverse the pattern to black lines on a white background.

You can adjust your image's size, position, uniformity, and geometry.

To adjust geometry:

1. Open the **Geometry** window.



The Geometry window appears on the test pattern as background.
In the upper half of the window you see a rectangular icon that represents your image. The icon has four handles on the edges. Position the mouse inside the icon. It changes to a grabber hand.
Position the mouse on the handles. It changes into a double arrow.
In the lower half of the window you see the list of eleven adjustments. Each adjustment has a text box and two Up/Down arrows next to it.

Figure 4.7

2. Adjust the settings you need.
   You can do this by:
   - Clicking the up/down arrows next to the adjustment.
   - OR directly entering a numeric value in the text box next to the adjustment.
   - OR dragging the icon in the top of the geometry window for horizontal and vertical position or dragging the handles at the edges of the icon for horizontal and vertical size.

   The changes you make immediately take effect.
3. Close the **Geometry** window.

Refer to the "Reference" chapter for more information about the different geometry and uniformity adjustments.

Tip: Use the Geometry window for minor corrections to your image. When you wish to install a new graphics board or you want to make drastic changes, select **New...** from the **Setup** menu or select **Yes** upon the question "Do you want to install new geometry settings and store them in a setup?". There you can start a completely guided adjustment procedure that guides you through the installation.

Only adjust the geometry settings if you are not satisfied with your image's geometry or uniformity. Do not touch them when you think your image is good. You may ruin a good image by playing with its geometry.

Caution: Drastic geometry changes affect the color fidelity. It is better to re-calibrate after geometry adjustment.

Degauss

A color display can have colored 'hot' spots. These are spots on the screen where the colors are deformed. This is mainly caused by remaining magnetic energy on the metal parts of the picture tube.

Degaussing or demagnetizing the display removes the remaining magnetism from the picture tube. As a consequence also the 'hot spots' on the screen disappear.

To perform a degauss action:

Click inside the **Degauss** box in the main window.
The image on your screen will "shiver" for a moment.
At the same time every other function is locked for a few seconds.

Reference Calibrator· and Mega Calibrator· displays have a so-called Quick Degauss circuit. The results are:

- The image shivers less.
- The degauss action is faster.
- The necessary time between two successive actions is minimal.

Remarks:

- The display always automatically degausses after start-up.
- Between two successive degauss actions you should wait at least:
  - •• 10 minutes when working with a Calibrator· or Calibrator· II
  - •• 7 seconds when working with a Reference Calibrator·or MegaCalibrator·

Password

It would be very annoying if another user would change or remove your Monitor Setups by mistake. You can therefore protect your Monitor Setups by installing a password.

You can enter the password by means of the **Use Password** option in the Preferences. When the password is installed, you cannot change a Monitor Setup whithout entering the password first.

Calibrator·Talk comes with an empty password after installation.

To install the password:

1. Select **Preferences** from the **File** menu.
2. Select **Use Password...**.

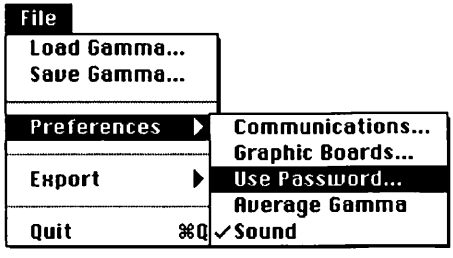


Figure 4.8

The Use password window appears.

In the top box you must enter the new password. In the bottom box you should repeat it for confirmation.

The password must be 6 characters maximum.

3. Enter the new password in the **New** box and click **OK**.
4. Enter the new password once more in the **Verify** box and click **OK**.

The **Use Password...** option in the Preferences is now checked.

To disable the password system:

1. Select **Preferences** from the **File** menu.
2. Select **Use Password...**
   The Use password window appears.
3. Enter the current password in the text box.
4. Click **OK**.
   The **Use Password...** option in the Preferences is now deselected.

4.2 Re-calibrating white-points

General

The colors of standard color displays tend to be unstable and unpredictable due to a number of causes, like:

- changes in ambient temperature
- changes in mains voltage
- aging of the picture tube

The Barco Calibrator - type displays eliminate ambient influences by means of internal feedback systems that guarantee high stability. The aging of the picture tube is compensated by re-calibration of the colors.
The **Auto Cal** function in the **Color** window allows you to easily re-calibrate your monitor, including the graphics board.

Important:
Use your Ambient Light Shield during re-calibration.

Calibrator-Talk offers the following possibilities:

- The main window indicates when the display must be re-calibrated.
- Re-calibration of one selected white-point, factory-defined or user-defined.
- Definition and calibration of a new user white-point setting.
  You can define it in Daylight value (Dxx) or in (x,y)-chromaticity coordinates.
- Re-calibration of the display only (**Standard Signal**) or the combination display-graphics board (**Graphic board signal**).
- Re-calibration with LUC included or excluded.

Extended re-calibration

Every tenth re-calibration is a so-called extended re-calibration. This means that the firmware restores the color model of the display. The only difference for the user is that this re-calibration takes about ten minutes.
Before the start of this re-calibration, Calibrator®Talk will display a message. If you wish to cancel the re-calibration, press "No". As a consequence the re-calibration isn't performed. The extended re-calibration is postponed till the following time you select Auto Cal.

Re-calibration with LUC on (only for MegaCalibrator®)

You have to re-calibrate the LUC system before you can optimally use it. An LUC re-calibration consists of two parts: it starts with a normal color re-calibration to re-calibrate the center of the picture tube. After the center re-calibration, the re-calibration of the edges starts.

1. Switch on LUC in the main window before you start re-calibration.
2. Open the **Color** window and perform **Autocal**.
   The software asks "Do you want to calibrate luminance uniformity too?". Select **Yes** if you wish to re-calibrate LUC, select **No** if you wish to re-calibrate *without* LUC.
3. Calibrator®Talk first starts with a normal re-calibration to re-calibrate the center of the picture tube. Then the re-calibration of the edges starts.
4. A gray blinking box appears on the screen. Put your Optisense® on the box. The box first appears in the center, and then moves to the edges. Follow the box with the Optisense®.

Re-calibrating existing white-points

To re-calibrate a factory-defined white-point:

1. Open the **Color** window in Calibrator Talk.
2. Select the white-point to re-calibrate (5300K, 6500K, or 9300K).
3. Select **Standard Signal** or **Graphic Board Signal**.
   The former is calibration without graphics board, the latter is with. When you re-calibrate with your graphics board included, Calibrator Talk eliminates the color differences between your display and graphics board.
   We suggest that you select graphic board re-calibration after installing a new graphics board.
   Graphic Board Signal calibration is sometimes referred to as External calibration, whereas Standard Signal calibration is Internal calibration.
4. Click the **Auto Cal** button.

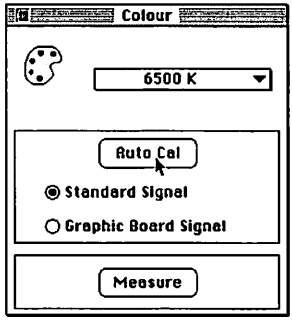


Figure 4.9

5. Position your Optisense in the middle of the screen.
   After having completed the re-calibration, Calibrator Talk displays the message "Calibration was successful". At the same time it produces an audible signal. You can possibly switch off this sound in the Preferences (**File** menu).
6. Click **OK**.

To re-calibrate a user-defined white-point:

1. Open the **Color** window in Calibrator·Talk.
2. Select the white-point to re-calibrate (User1 or User2).
3. Select **Standard Signal** or **Graphic Board Signal**.
   The former is calibration without graphics board, the latter is with. When you re-calibrate with your graphics board included, Calibrator·Talk eliminates the color differences between your display and graphics board.
   We suggest that you select graphic board re-calibration after installing a new graphics board.
   Graphic Board Signal calibration is sometimes referred to as External calibration, whereas Standard Signal calibration is Internal calibration.
4. Click the **Auto Cal** button.
   The white-point definition window appears.

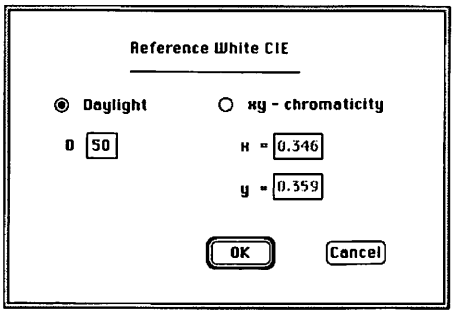


Figure 4.10

   Here you can enter the white-point value you want to re-calibrate. You can specify it in Dxx format (daylight coordinates) or (x,y) format (chromaticity coordinates).
   When re-calibrating an existing user-defined white-point, don't alter the values in this window.
5. Click **OK** to proceed.
6. Position your Optisense· in the middle of the screen.
   After having completed the re-calibration, Calibrator·Talk displays the message "Calibration was successful". At the same time it produces an audible signal. You can possibly switch off this sound in the Preferences (**File** menu).
7. Click **OK**.

Tip: It is important to re-calibrate your commonly used white-points regularly. We advise you perform a re-calibration every 300 hours of operation.

A prompt will appear on the LCD panel of the display at the appropriate time.

Select internal calibration (Standard Signal) before installing a new graphics board or when you temporarily work with a board you are not going to use for a long time.

Select external calibration (Graphic Board Signal) when you are working on a stable, fixed system: When you are going to use the combination display-graphics board for a long time.

Remarks:

- Should your computer be equipped with more than one graphics board, first select the board your Barco display is connected to. You can do this by means of the **Graphic Board...** option in the **File** - **Preferences** menu.
- Graphic board calibration is only possible when your graphics board is configured to **Millions of colors** (Macintosh Monitors control panel) or when it has a color LUT (Windows).
- We recommend to let the Optisense· warm up for fifteen minutes before you actually start the calibration.
- For precise adjustments we recommend to cover (the picture tube of) your display during the calibration by using your Ambient Light Shield.

Defining and calibrating a new white-point

The Barco Reference Calibrator· and MegaCalibrator· displays come with three factory-defined and two-user-definable white-points, as already explained.

You can alter the user-definable white-points to another value, should you require this. Therefore you need to select one of the user white-points, specify a new white-point value, and calibrate it.

To define and calibrate a new white-point:

1. Open the **Color** window in Calibrator·Talk.
2. Select the white-point to re-calibrate (User1 or User2).
3. Select **Standard Signal** or **Graphic Board Signal**.
   The former is calibration without graphics board, the latter is with. When you calibrate with your graphics board included, Calibrator·Talk eliminates the color differences between your display and graphics board. We suggest that you select graphic board calibration after installing a new graphics board.
   Graphic Board Signal calibration is sometimes referred to as External calibration, whereas Standard Signal calibration is Internal calibration.
4. Click the **Auto Cal** button. The white-point definition window appears.

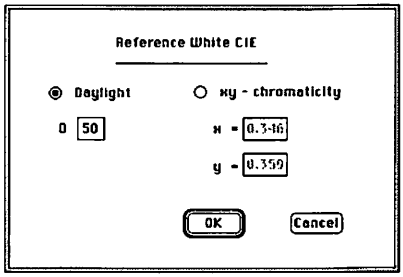


Figure 4.11

   Here you can enter the new white-point value you wish to calibrate. You can specify it in Dxx format (daylight coordinates) or (x,y) format (chromaticity coordinates).
   In Daylight coordinates you can enter a value from D50 to D200 FOR Reference Calibrator® and from D50 to D99 for Mega Calibrator®.
   For a list of (x,y) coordinates, please refer to the User Manual of the display.
5. Click **OK** to proceed.
6. Position your Optisense· in the middle of the screen.
   After having completed the re-calibration, Calibrator·Talk displays the message "Calibration was successful". At the same time it produces an audible signal. You can possibly switch off this sound in the Preferences (**File** menu).
   If you tried to calibrate a white-point that is beyond the display's range, Calibrator·Talk displays the message "Highlight overflow".
7. Click **OK**.

Remarks:

- Should your computer be equipped with more than one graphics board, first select the board your Barco Calibrator· display is connected to. You can do this by means of the **Graphic Board...** option in the **File - Preferences** menu.
- We recommend to let the Optisense· warm up for fifteen minutes before you actually start the calibration.
- For precise adjustments we recommend to cover (the picture tube of) your display during the calibration by using your Ambient Light Shield.

4.3 Working with monitor setups

When you connect a computer with new graphics board to your display, you have to adjust a number of settings to get a matched image. This complete set of settings we call a *monitor setup*.

A monitor setup consists of the following settings:

- PICTURE and BACKGROUND settings.
- Geometry settings.
- White-uniformity settings.
- Convergence settings *.
- Focus settings **.
- User-defined color temperature definitions.

* Only for Reference Calibrator® & MegaCalibrator® displays.
** Only for MegaCalibrator® displays.

The Barco displays contain at least one factory-defined setup. You can additionally define new (user) setups. The possibilities differ slightly from the type of monitor: Calibrator· (II), Reference Calibrator·, or MegaCalibrator·.

- In Calibrator· and Calibrator·II, the factory setup is called CAL. This is the calibrated setup for your application. You can change two user setups: PRESET 1 and PRESET 2.
- In the Reference Calibrator· and MegaCalibrator· the name of the factory setup refers to the graphics board you are using. You can:

- Select one of the monitor setups from the memory (during startup, the display normally selects a monitor setup automatically).
- Change the settings from the selected monitor setup, in case the image isn't aligned to your satisfaction.
- Create a new monitor setup, in case you have installed a new graphics board or a new display.
- Remove (clear) a monitor setup from the memory.

Factory-defined setups cannot be changed, nor removed.

Selecting a monitor setup

To select a Monitor Setup:

1. Choose **Select...** from the **Setup** menu.
   You now get a list with all the possible setups.

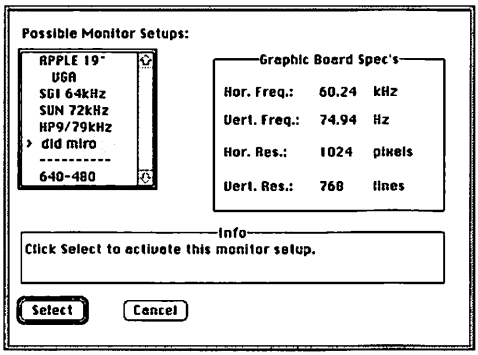


Figure 4.12

   On the right hand side of the Monitor Setup window, you see the specifications of the selected graphics board.
2. Pick the desired setup from the list.
   You can only select a monitor setup that matches the video signal applied to the display.
3. Click the **Select** button.
   The Monitor Setup window now closes.
   Calibrator·Talk and the display will adopt the settings from the selected monitor setup.

Changing an existing monitor setup

To change an existing Monitor Setup:

1. Choose **New...** from the **Setup** menu.
   The guided installation procedure now starts. Please refer to the information in the article "The guided installation procedure"..
2. Complete the installation procedure.
3. After completion you get the list of setups.
   The current setup name is highlighted.

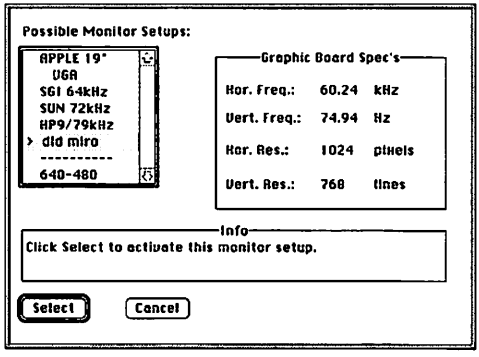


Figure 4.13

4. To change the selected setup, click the **Save** button without altering the setup name in the **Name** box.
   The software now asks if you wish to overwrite the current Monitor Setup. Click **Yes** to store the changes.

After changing any of the settings, you must re-calibrate your white-points.

The guided installation procedure

The guided installation procedure covers a large number of adjustments you need to perform to accurately adjust your complete display.

The adjustments appear in a window that allows you to perform the adjustments and step through the procedure.
At the same time you get a pattern that depends on the adjustment you are performing. The help text that accompanies the adjustment, refers to the test pattern.

All the adjustments are divided in different chapters. *You step forward and backward to other adjustments in the same chapter, or to other chapters directly.*

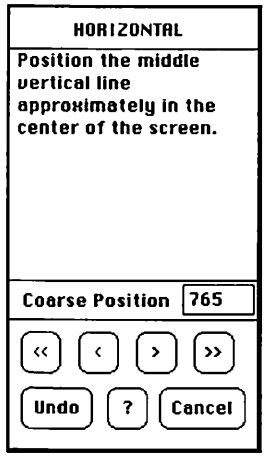


Figure 4.14

You can adjust by:
- *changing the value in the text box in the adjustment window*
- *OR by moving the slider that is visible in the test pattern on the screen*

You can move through the procedure by clicking:

>	*Move to the next adjustment.*
>>	*Move to the next chapter of adjustments.*
<	*Move to the previous adjustment.*
<<	*Move to the previous chapter of adjustments.*
Undo	*Undo the changes in the current adjustment.*
?	*Display Help.*
Cancel	*Stop the procedure without saving changes.*

The different steps are:	
Horizontal adjustments *Horizontal Position (coarse)*	
Horizontal Size (coarse)	
Horizontal Linearity	
Horizontal S-correction	
Horizontal Position (fine)	
Horizontal Size (fine)	
Horizontal Blanking left	
Horizontal Blanking right	
Screen rotation	
Vertical adjustments *Vertical Position (coarse)*	
Vertical Size	
*Vertical Linearity***	
*Vertical S-Correction***	
Vertical Position (fine)	
*AKB Removal***	
Vertical Blanking	

East-West adjustments *East-West Skewing* *East-West Trapezium* *East-West Parabola (coarse)* *East-West Bowing* *East-West Parabola (fine)* *Horizontal Position (fine)*	
*North-South adjustments*** *North-South Top Amplitude* *North-South Bottom Amplitude* *North-South Left Amplitude* *North-South Right Amplitude* *North-South Top Tilt* *North-South Bottom Tilt*	
*Focus adjustments*** *WaveForm Delay* *Focus Adjustment*	
Convergence adjustments *Horizontal Static* *Vertical Static* *Advanced Procedure***	

Uniformity adjustments *Vertical* *Axial* *Screen rotation* *Left Lateral*** *Right Lateral*** *** Only for MegaCalibrator*	
***Remark:** After completing the guided installation procedure, you must re-calibrate the white-points you often use.*	

Installing a new graphics board / Defining a new monitor setup

To define a new monitor setup:

1. Choose **New...** from the **Setup** menu.
   The guided installation procedure now starts. Please refer to the information in the article above.
2. Complete the installation procedure.

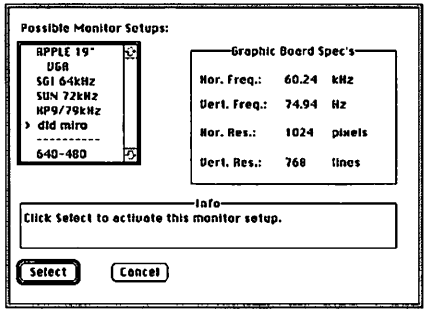


Figure 4.15

3. After completion you get the list of setups.
4. Select **Untitled** from the list of setups.
5. Enter a name of maximum10 characters in the **Name** text box. Avoid to use a comma (,) and a colon (:) in the name.
6. Click the **Save** button.

Remark: Untitled is not visible in the list when the memory of the display is full. In that case you must change an existing setup.

Removing a monitor setup

To remove a monitor setup:

1. Choose **Remove...** from the **Setup** menu.
   You now get a list with all the possible setups.
   The current monitor setup is highlighted.

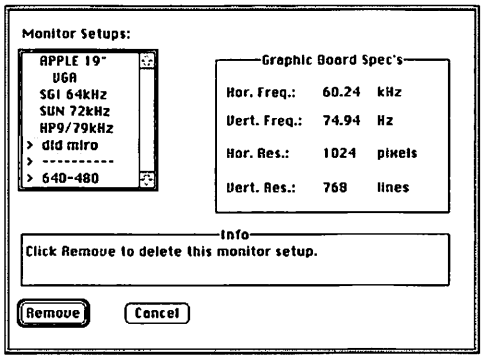


Figure 4.16

2. In case you wish to remove another setup than the current one, select the desired setup from the list.
   You cannot remove factory-defined monitor setups.
3. Click the **Remove** button.
   The software now asks you to confirm your intention to clear this monitor setup. Select **Yes** to confirm.

In case you have removed the current setup, the display automatically selects another setup that matches the incoming video signal. Therefore the display should have been switched in "Automatic Mode selection" (which is the default setting) before Calibrator®Talk was started. Should you have problems with that, please consult the display's User Manual or contact your system administrator.

4.4 Using Calibrator®Talk in combination with other software

Calibrator·Talk proves to be an extremely valuable tool because it allows you to perfectly integrate your display in a color system where other software is used.
In this chapter we have tried to cover most of the applications in which you can make use of Calibrator·Talk: Scanning an image, working under a Color Management System, and working with an image processing program.
But first we explain the advantages of using Calibrator·Talk in combination with color application software.

The importance of combining color applications with Calibrator®Talk

As we stated in the introduction, Calibrator·Talk improves color accuracy when combined with other color software.

Color accuracy mainly depends on:
- the stability of the color devices
- the calibration of the color devices
- the exact knowledge of the device's behavior
- the exact color calculation in the application software

As already explained, Calibrator·Talk:
- allows to easily re-calibrate the display
- allows to control the graphics board - display's gamma behavior
- exactly knows the display's color behavior
- can supply the necessary information about display's color behavior to the color application so that the application can exactly calculate colors.

Scanning an image

When you want to display and process a scanned picture on your monitor, it is very important to know how to set your gamma. You should choose the same gamma for your display as the one with which you are scanning. Keep in mind that the scanner gamma is usually 1, if you don't apply tone correction.

Without tone correction

In the following example we use an AGFA Arcus RX scanner in combination with FotoLook 1.0 scanner software.

Before you start scanning, set the following parameters:

1. In Calibrator Talk, set gamma to 1.
   E.g., select **Automatic Gamma**, **Light Surround**.
2. In FotoLook, select **Tone Curve**: None.
   This setting corresponds to a gamma of 1.

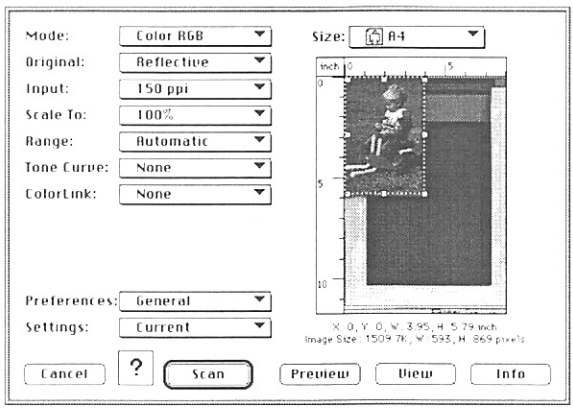


Figure 4.17

Now you can start scanning.

With tone correction

In the following example we use an AGFA Arcus RX scanner in combination with FotoLook 1.0 scanner software. As tone correction we select a gamma of 2.2.

Before you start scanning, set the following parameters:

1. In FotoLook, select **Tone Curve**: Gamma 2.2.
2. In Calibrator Talk, select Average Gamma in the Preferences.
3. In Calibrator Talk, set gamma to 2.2.
   Therefore select **Manual Gamma** and enter the number 2.2 for the three colors.

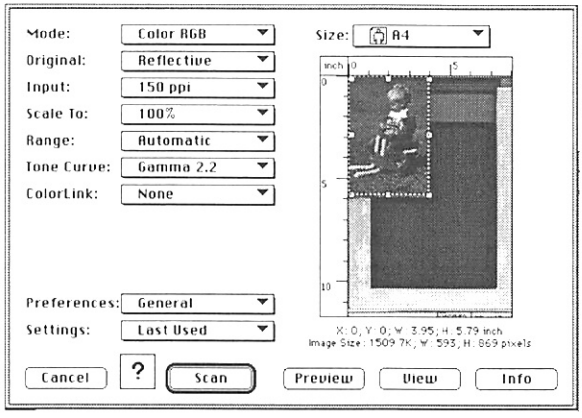


Figure 4.18

Now you can start scanning.

Remark: The number for gamma in some scanner programs should be interpreted as gamma *correction* value instead of gamma value. E.g., if this scanner software displays a tone curve with "gamma" 0.5, you should set the monitor gamma to 2 in Calibrator Talk.

Feeding device data to a Color Management System

A Color Management System (CMS) is a software package that eliminates the differences in color behavior between the different devices in a color system (scanner, display,...). The philosophy behind a CMS is to translate the specific color behavior of a color device into device-independent information. This can be accomplished because each device in the color system delivers a 'passport' (like Agfa ColorTag) to the CMS. The CMS now uses these passports to link the different color devices.

The CMS also needs the passport from your Barco display. You can deliver this by means of Calibrator·Talk. This passport is based on the display's Calibrator· Characteristic Parameters (CCP), thus is unique and exact for each different display!
In other words, *you can improve color accuracy by using Calibrator·Talk.*

The CCP is a list of parameters that are unique and exact for each display. They are:

- average white light output
- picture tube phosphor coordinates
- picture tube gamma values
- luminance values

In the example below we illustrate the use of Calibrator·Talk with the CMS Agfa FotoTune.
For the use of Calibrator·Talk with other CMSs, please refer to the ReadMe's, supplied with the software, or to Appendix D: Generic Display Values. You can supply the necessary device data from the list you find here to a CMS of which Calibrator®Talk doesn't have built-in filters.

Working with AGFA FotoTune

In the following example we use the AGFA **FotoTune 1.1** CMS. If you work with FotoTune 2.x, please change the following:

- Selected color temperature: whatever.
- Selected gamma: whatever.
- Creation of ColorLink: not in FotoTune, but directly in Adobe Photoshop's **Filter...** menu.

To communicate with FotoTune 1.1:

1. In Calibrator·Talk, select D50 as color temperature.
   Remark: From FotoTune 1.3 on you can skip step no. 1.
2. Calibrate this color temperature. Select **Graphic Board signal** and click the **Auto Cal** button. Calibrator·Talk now calibrates the monitor-graphics board combination.
3. In Calibrator·Talk, select Average Gamma in the Preferences.
4. In Calibrator·Talk, set gamma to 1.
   E.g., select **Automatic Gamma**, **Light Surround**.
5. Create a ColorTag for the particular monitor you are working with.
   Therefore select **Export** from the **File** menu. Select **Agfa ColorTag**.

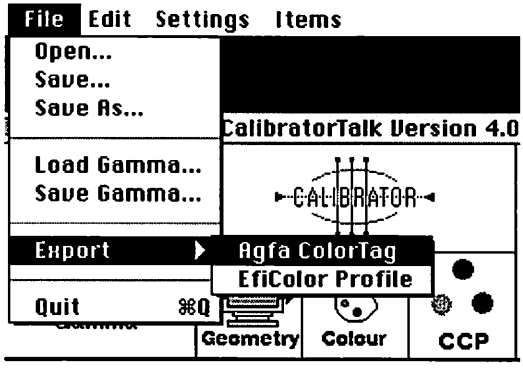


Figure 4.19

6. The Agfa ColorTag maker window appears.
   Click **Continue**.

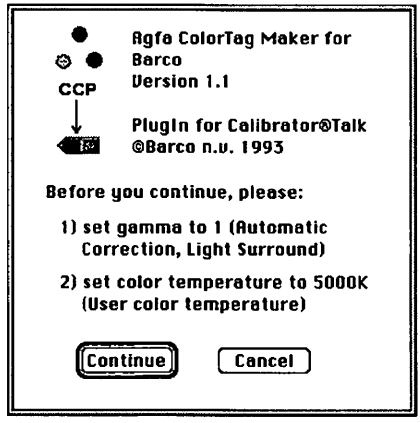


Figure 4.20

The ColorTag Maker translates the monitor CCPs into a ColorTag for your particular Calibrator monitor. Its name is made of the Calibrator model (BarcoCali), followed by the monitor's serial number.

You should now link the ColorTag from the display to the one from the scanner. Therefore create a so-called ColorLink by means of the FotoTune application.

6. Start FotoTune.
7. In FotoTune, create a ColorLink between the scanner and your monitor.

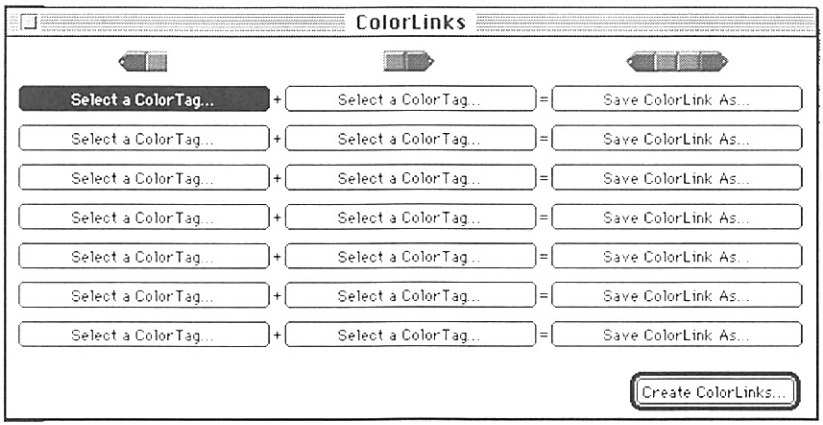


Figure 4.21

- Click the left **Select a ColorTag** button and select the scanner's ColorTag as input tag.
- Click the right **Select a ColorTag** button and select the monitor's ColorTag as output tag.
- Click the **Save ColorLink As ...** button and save the ColorLink between both.

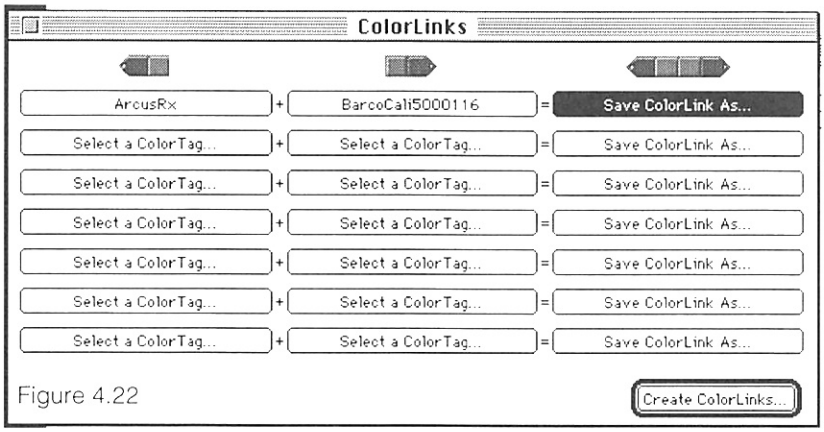


Figure 4.22

• Click the **Create ColorLinks...** button to actually create the ColorLink.

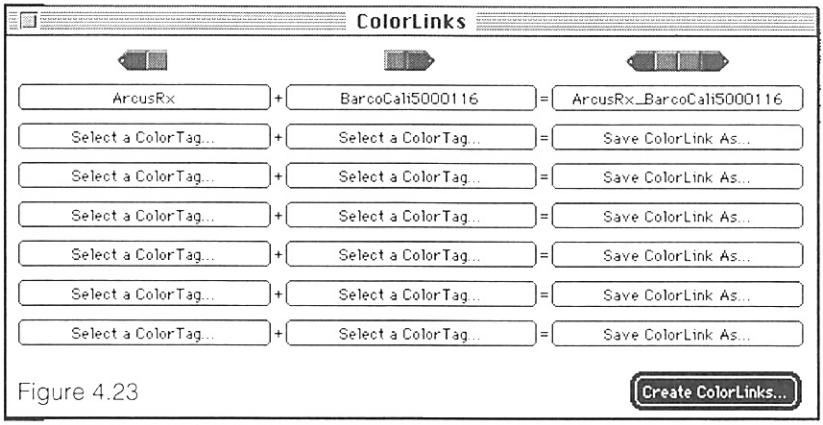


Figure 4.23

You can now use the created Color Link in other software applications that support FotoTune to match the colors of monitor and scanner. For an example, refer to "Working with Adobe Photoshop" in the next paragraph.

Working with Adobe Photoshop

When you work with image processing programs, you need to be sure about the colors of the images on your screen. That is why the program needs to know your display characteristics and settings, only then it will be able to produce correct colors on the display. Calibrator·Talk helps you with this job. Your display settings depend on the source of the images: Scanned or from Kodak PhotoCD.

In this example we work with the AGFA Arcus RX scanner and AGFA FotoTune 1.1 CMS.

Working with scanned images

When you work with scanned images in Photoshop, you additionally need to create a ColorLink (or similar link, according to your CMS) between scanner and monitor. Refer to the examples of scanning an image and "Working with AGFA FotoTune".

To create a ColorLink:

1. In Calibrator·Talk, set gamma according to your scanner gamma.
2. In Photoshop, set the **Monitor Setup** (see below).
3. In Photoshop, select FotoTune (or other CMS) from the **Filter** menu (see fig. 4.26).
4. Select RGB-ColorLinker 1.1.
5. Select the particular ColorLink between scanner and display from the list of ColorLinks displayed.

Now the colors on your display match those of the scanned image.

Remark:

From FotoTune 2.0 on, the filter in Photoshop is called FotoTune... ColorMatcher 2.0.

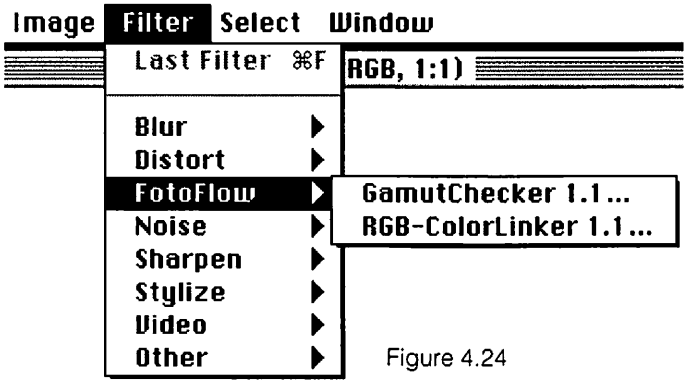


Figure 4.24

Working with images from Kodak PhotoCD

1. In Calibrator·Talk select **Load Gamma** in the **File** menu.
2. Select **Gamma Value-YCC-709** from the list displayed.
3. Select color temperature D65.
4. In Photoshop, set the **Monitor Setup** (see below).
5. In the Photoshop **Monitor Setup**, set the gamma to 2.2.

Now the colors on your display match those of the Kodak PhotoCD image.

Setting Monitor Setup in Photoshop

Whenever you work with Photoshop it is important to set your monitor setup according to the specifications of your particular Calibrator· display.

1. Select **Preferences** from the **File** menu.
2. Select **Monitor Setup**.
3. In the Photoshop Monitor Setup window set the following parameters:

- Monitor: BARCO Calibrator.
- Gamma: The same value as the average gamma in Calibrator·Talk.
- White point: The same value as in Calibrator·Talk.
- Phosphors: Custom... Here you fill out the phosphor values you read in Calibrator·Talk's CCP window.
- Room parameters: Ambient Light: High

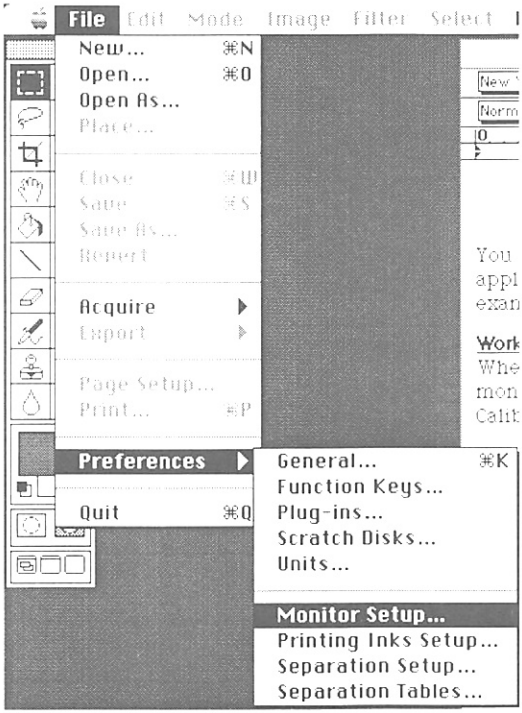


Figure 4.25

Tip: In case you wish to compare colors, measured in Calibrator Talk, with the parameters of the same color in Photoshop, you have to open an L*a*b* file in Photoshop, and measure the color in L*a*b* in Calibrator Talk. Of course you will get the best results after the display has been re-calibrated.

Judging an image on Silicon Graphics

Suppose: you wish to view the same image on two different computers, both connected to a Barco display*. You desire that it looks the same on both displays.

The general rule is: the *overall Gammas* of both computer-display combinations must be equal.

The only difficulty is that Gamma is handled differently on different systems:

a) Macintosh, Windows, or SUN platform.

The overall Gamma is the Gamma you set in Calibrator®Talk.

b) Silicon Graphics platform.

The overall Gamma is the product of 3 Gammas: Gamma of the display, Gamma of the application in which you view the image, Gamma of the Operating System.

- The Display Gamma (DG) you can see in the CCP window in Calibrator®Talk.
- The Gamma of the application, or Window Gamma (WG), you can see in the application's Preferences.
- The Gamma of the Operating System, or System Gamma (SG), you can find by entering the command Gamma in a UNIX shell. The figure UNIX returns is the Gamma correction value.

So the System Gamma is the inverse of this figure.

Conclusion:
- Both Overall Gammas must be equal
- On SGI, Overall Gamma = DG * WG * SG

If you follow these guidelines, you should get a good result. To make it more concrete for you, we have worked out three numerical examples: one where you compare the image on two different types of system, and two where you compare it on two SGI systems.

* Calibrator®Talk operates with Barco display types Calibrator®, Reference Calibrator® and Mega Calibrator®.

First possibility: one workstation is SGI, the other is Macintosh, Windows, or Sun.

Method:

1 Set the Overall Gamma of the second system by means of Calibrator®Talk.
2 Get the Window Gamma and Display Gamma from the SGI.
3 Calculate the SGI's system Gamma and enter it in UNIX.

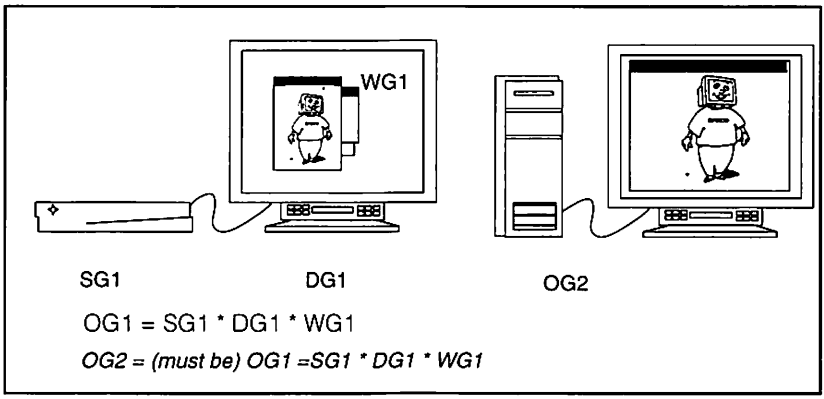


Figure 4.26

Example:

1. On the second system:
   1.1 In Calibrator®Talk, select Default Gamma Correction.
   So the Overall Gamma, *OG2 = 2.2.*

2. On the Silicon Graphics system:
   2.1 Window Gamma (WG1).
   In the preferences of the application, you find that *WG1 = 1.*
   2.2 Display Gamma (DG1).
   Here we have to work with the average Gamma, i.e., the average of the display's three color channels.
   The CCP window in Calibrator®Talk gives the following Gamma values for the display connected to SGI: Gamma R = 2.45, Gamma G = 2.44, Gamma B = 2.46.
   So the average Display Gamma, *DG1 = 2.45.*
   2.3 System Gamma (SG1).
   From the formula, we know that the Overall Gamma of SGI should be equal to the other system's Overall Gamma: OG1 = OG2, or:
   SG1 * WG1 * DG1 = OG2.
   So SG1 = OG2 / (WG1 * DG1) = *2.2 / (1 * 2.45) = 0.90.*
   2.4 The system manager has to enter a Gamma correction value of 1 / 0.48 = 2.08 in a UNIX shell.

Second possibility: both are SGI.

In this case, we *propose* two different methods. The first method is a little bit less accurate, but might still give a good result The second method is in fact the only accurate one. In both cases you need to set the System Gamma. So you need the System Password.

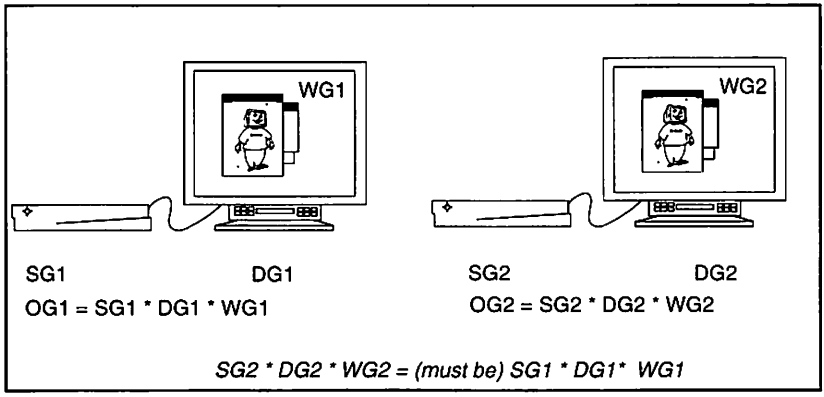


Figure 4.27

First method: not taking individual display Gammas into account:

1 Get the System Gamma (SG1) and Window Gamma (WG1) of the first SGI.

2 Set the System Gamma (SG2) and Window Gamma (WG2) of the second SGI system equal to those of the first one (SG2 = SG1 and WG2 = WG1).

Example:

1. On the first SGI system:
   1.1 System Gamma.
   By means of the **gamma** command, you get the figure *2.2* (Gamma correction).
   1.2 Window Gamma.
   In the preferences, you find that *WG1 = 1.*

2. On the second SGI system:

2.1 Window Gamma.
In the application window on the second system, in the preferences, enter a Gamma *WG2 = WG1* = 1.

2.2 System Gamma.
The system manager has to enter a Gamma correction value of *2.2* in a UNIX shell.

Second method: taking the individual display Gammas into account:

1 Get the three Gammas of the first SGI system.

2 On the second SGI system, get the Display Gamma, set the Window Gamma equal to that of the first system, and set the System Gamma.

Example:

1. On the first SGI system:

1.1 System Gamma.
By means of the **gamma** command, you get the figure 2.2. This is the Gamma correction value.
So *SG1 = 0.45* (= 1 / 2.2).

1.2 Window Gamma.
In the preferences, you find that *WG1 = 1.*

1.3 Display Gamma.
The CCP window in Calibrator®Talk gives the following Gamma values for the display connected to the first SGI: Gamma R = 2.45, Gamma G = 2.44, Gamma B = 2.46.
So the average Display Gamma, *DG1 = 2.45.*

2. On the second SGI system:

2.1 Display Gamma.

The CCP window in Calibrator®Talk gives the following Gamma values for the display connected to the second SGI: Gamma R = 2.29, Gamma G = 2.31, Gamma B = 2.30.

So the average Display Gamma, *DG2 = 2.30.*

2.2 Window Gamma.

On the application window on the second system, in the prefer ences, enter a Gamma *WG2 = 1.*

2.3 System Gamma.

The general rule is, that both Overall Gammas must be equal.

So SG1 * DG1 * WG1 = SG2 * DG2 * WG2.

Because we have set both Window Gammas equal, we can ignore them in the above formula. So SG1 * DG1 = SG2 * DG2.

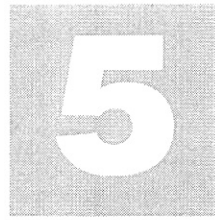
*So SG2 = (SG1 * DG1) / DG2 = (0.45 * 2.45) / 2.30* = 0.48.

Therefore, the system manager has to enter a Gamma correction value of 1 / 0.48 = 2.08 in a UNIX shell.

Note:

In case you would have followed method no. 1, you would have entered a Gamma correction value of 2.2 instead of 2.08. This means you would have made a 'Gamma mistake' of 0.12, which is a little bit visible.

This proves that it is still better to use the individual display parameters. Only then you get the full benefit of the color accurate advantages the Barco displays offer.



REFERENCE

This chapter explains all the Calibrator®Talk windows, menus and functions in *alphabetic* order.

About (File menu)

This activates a box where version and serial numbers are displayed:

- Calibrator®Talk software version.
- Display serial number.
- Display software version.
- Optisense® serial number (not for Reference Calibrator® and Mega Calibrator®).

ALC on/off

ALC is short for Ambient Light Control.

You can find the ALC option in the main window.

If your set is equipped with ALC, you can switch it on or off. It allows you to automatically adjust PICTURE and BACKGROUND, taking the ambient light around the display into account.

Remark: When ALC is switched on, PICTURE and BACKGROUND control are no longer active. They are controlled by the ALC circuit.

Arbitrary Correction (Gamma)

The arbitrary correction makes it possible to specify any correction function that you desire.

The Arbitrary Gamma window contains the following items:

- Three curves that show the current gamma functions for the three colors: Red, Green, and Blue.
- Three text boxes with the gamma values corresponding to the curves. If you have entered an arbitrary function, this number is not filled out.

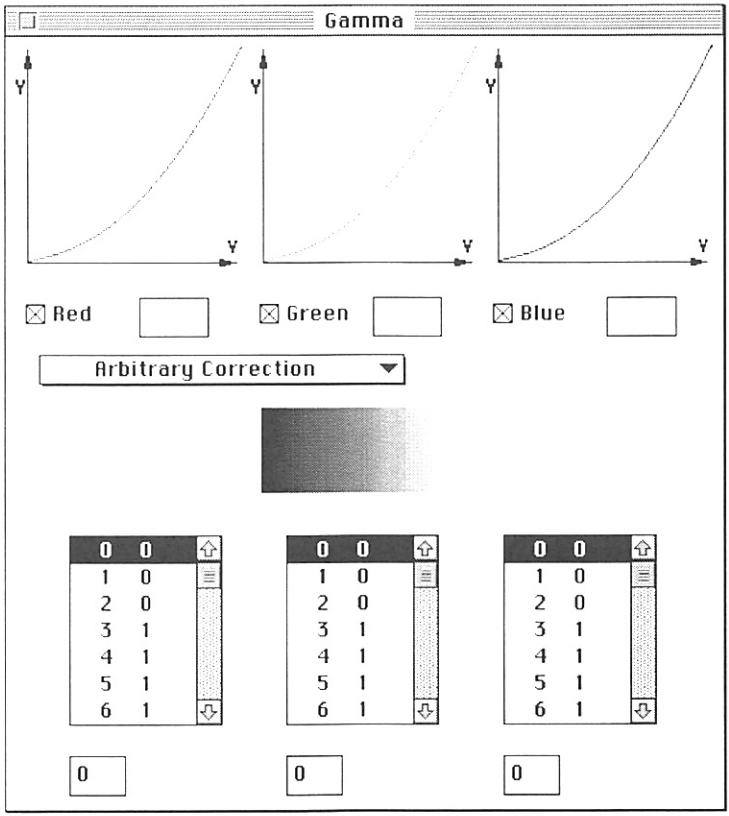


Figure 5.1

- Three check boxes that can 'link' two or all three gamma values. If you change one of the linked ones, the other(s) change accordingly. Select them to link, and deselect to dissolve.
- A gray-scale pattern that shows the result of the gamma function.
- Three tables that show the current overall gamma values of your graphics board-display system. The values in the tables correspond to the gamma curves shown in the upper half of the window.
  The first column represents the values on the V-axis of the corresponding curve. The second column represents the Y-values that correspond to the V-values.
- Three text boxes in which you can change the values one at the time.

Auto Cal (Color)

This function lets you re-calibrate a factory-defined or user-defined color temperature, or calibrate a new user-color temperature.

Important:
Use your Ambient Light Shield during calibration.

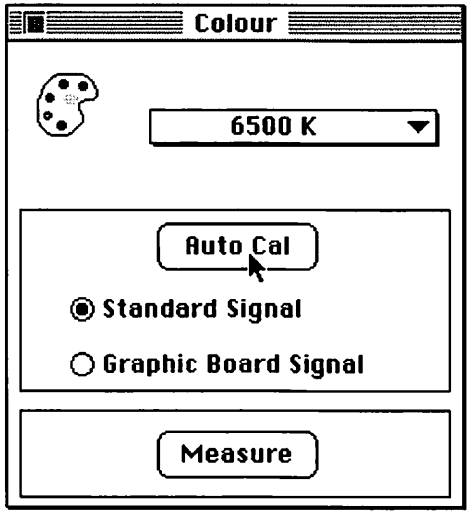


Figure 5.2

Before starting re-calibration you need to select between two options:

- Graphic Board Signal: Calibrator®Talk uses a signal, generated by the computer, to re-calibrate the display. So here you re-calibrate the combination graphics board - display. In this way you eliminate possible color errors between graphics board and display.
- Standard signal: Calibrator®Talk uses a video pattern, generated by the display, to re-calibrate.

So in that case you only re-calibrate your monitor.

If you selected a factory-defined white-point to re-calibrate, the calibration starts. If you selected a user-defined white-point, the Reference White window appears.

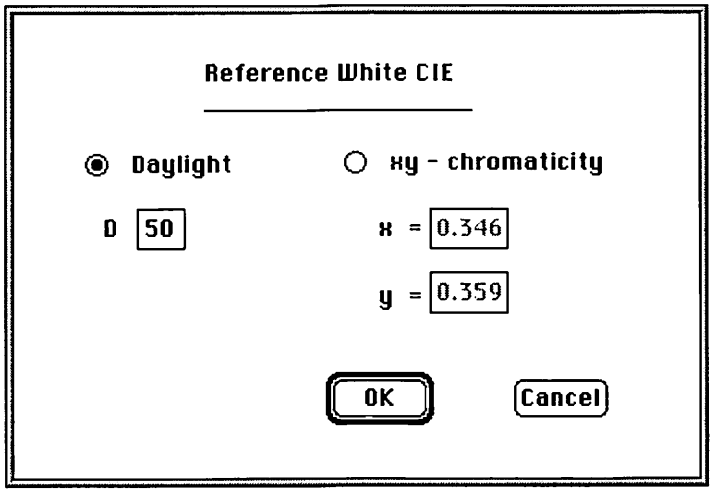


Figure 5.3

The Reference White window contains:

- Header: Reference White CIE 1931.
  This means that the reference white-point is defined according to the standard, set by the "Commission Internationale d' Eclairage" in 1931.
- Daylight Option.
  Select if you want to define a white-point that is situated on the Daylight curve (see Appendix A: About Color).
  You can fill out a number from 50 to 200 (Reference Calibrator®) or from 50 to 99 (Calibrator®, Calibrator®II and Mega Calibrator®).
- xy-chromaticity.
  With this option you can specify any white-point within the color gamut of the display.
  Therefore separately fill out the x and y coordinate of the white point.
  You can find a list of xy-coordinates in the user manual of the display.

Remarks:

- Should your computer be equipped with more than one graphics board, first select the board your Barco Calibrator® display is connected to. You can do this by means of the **Graphic Board...** option in the **File** - **Preferences** menu.

- We recommend to let the Optisense® warm up for fifteen minutes before you actually start the calibration.
- For precise adjustments we recommend to cover (the picture tube of) your Calibrator® during the calibration by means of your Ambient Light Shield.

Automatic Gamma Correction

Automatic Gamma Correction offers you the possibility of compensating automatically for the non-linearity of the three picture channels Red, Green and Blue.
Usually the three gamma values slightly differ. The gamma values for each Calibrator® channel are stored in the Calibrator®.
With these values, the computer calculates the correction tables. The Automatic Gamma Correction also compensates for the behavior of the human eye for different surrounding conditions. Different surrounding conditions are selectable in the right selection box.

The Automatic Gamma window contains the following items:

- Three curves that show the current gamma for the three colors: Red, Green, and Blue.
- Three text boxes with the current gamma values, corresponding to the curves.
  They are grayed, indicating that you cannot change them.
- Also the Gamma link boxes are grayed, indicating you cannot select or deselect them.
- A gray-scale pattern that shows the result of the gamma function.
- The Surround conditions box, where you can select out of four different surround conditions. Each condition corresponds to another gamma setting. The 'surround' refers to the border around the images on your screen or to the background of your monitor in the room you are working.

Light surround:

Light surround automatically compensates for an overall gamma of 1. This means that the relation between the RGB values you choose in the color picker and the light that comes out of the monitor is linear. If you select an R-value twice as large, the Calibrator® will display a red color with a luminance which is two times larger.

Dimmed surround 1:

This selection compensates to an overall system gamma of 1.15.

Dimmed surround 2:

The combination of LUT and Calibrator® has an overall gamma of 1.25.

Dark surround:

The combination of LUT and Calibrator® has an overall gamma of 1.5.

Average Gamma (File > Preferences)

This option allows you to select whether Calibrator®Talk has to work with the average of the three gamma values (for R, G and B) of your Calibrator, or not.

Working with an Average Gamma avoids possible undesired color effects in the gray scales of your Calibrator. These might be caused by resolution problems in the LUTs on your Graphics board.

When the Average Gamma option is selected, there is a check mark before the item.

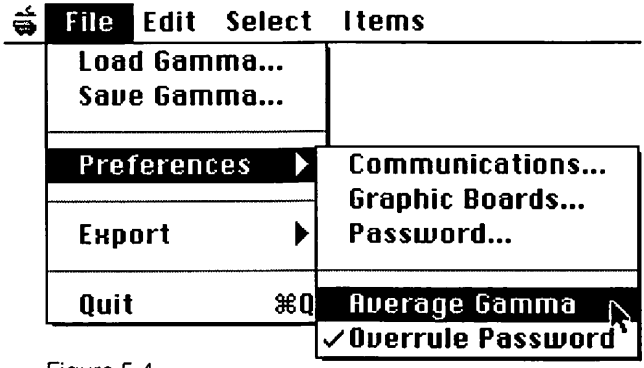


Figure 5.4

Axial White (Geometry)

The axial white coil compensates for disturbing magnetic fields in the axial direction of the monitor.
Such a field will have the effect of rotating your image a little bit.

Adjust by:
- Clicking the up/down arrows next to the Axial White box.
- Directly entering a numeric value in the Axial White box.

BACKGROUND

BACKGROUND adjusts the brightness of the image.

You can adjust BACKGROUND by means of the slider in the Main window. The value is indicated in the text box, left of the slider bar.
You can:
- drag the slider to the left (decrease) or the right (increase)
- click inside the slider bar, left or right of the slider (large steps)
- click the arrows, left or right of the slider bar (small steps)
- click the text box next to the slider bar and manually change the value

A value of 100 means: calibrated. Remember the colors on the screen are only truly calibrated when BACKGROUND and PICTURE are in calibrated position. So always put BACKGROUND control in CAL position when working with a Color Management System.

To put BACKGROUND in calibrated position:
- click CAL under the BACKGROUND icon
- OR set the BACKGROUND to 100

CCP

This feature allows you to read the Calibrator® Characteristic Parameters. These parameters describe the colorimetric behavior of the Calibrator® in a mathematically defined way. They are unique and exact for each different display. They are measured at the time of production of the display and stored inside its memory.

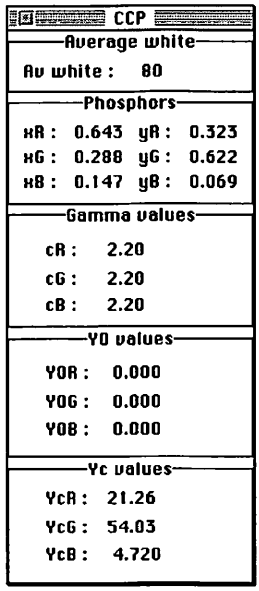


Figure 5.5

They are:

- Average white: This is the target light output, expressed in Cd/m², when the monitor is fed with video signals of 700 mVpp and when PICTURE and BACKGROUND are in calibrated position.

- Phosphors: These are the color coordinates in the CIE (x,y)-chromaticity diagram of the three phosphors (Red, Green, Blue) used in the picture tube.
- Gamma values: These are the gamma values of the three color channels of the picture tube.
- Y0: This is the light output, expressed in Cd/m², for each color, when the monitor is fed with video signals of 0 Vpp and when PICTURE and BACKGROUND are in calibrated position.
  In other words, this is called the 'residual' light output.
- Yc: This is the light output, expressed in Cd/m², for each color, when the monitor is fed with video signals of 700 mVpp and when PICTURE and BACKGROUND are in calibrated position.
  In other words, this is called the 'calibrated' light output.

Calibrator®Talk uses the CCPs to create a unique and exact 'passport' for the display, precisely describing the display's color behavior. This passport can be exported to Color Management Systems.
You also need the CCPs to define the Monitor Setup for your display in programs like Adobe Photoshop. See the example "Working with Adobe Photoshop" in the previous chapter.

Color

This is perhaps the most important window of Calibrator®Talk. It allows you to select another color temperature, re-calibrate the white point between D50 - D200 (Reference Calibrator®) or D50 - D99 (Calibrator® and Mega Calibrator®), and measure a color on the screen.

The Color window contains:

- White-point selection box.
  You can select between five white-points: three factory-defined, and two user-defined ones.
- Auto Cal button.
  This button starts the re-calibration of the currently selected white-point.

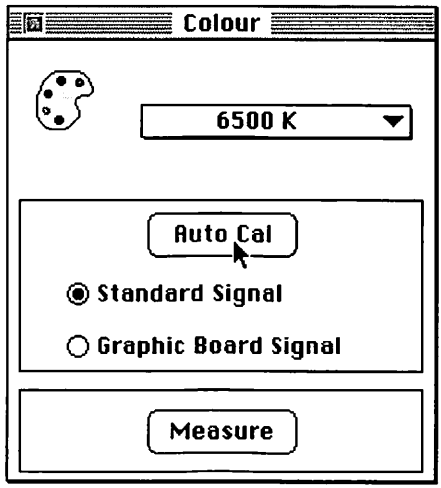


Figure 5.6

You can additionally define and calibrate a new user white-point. The re-calibration is done by means of the Optisense®.

- Standard / Graphic Board Signal.
  Select Standard Signal to re-calibrate the display only. In that case Calibrator®Talk uses a signal from the display itself to perform the re-calibration. This method is sometimes called *Internal* calibration.
  Select Graphic Board Signal to re-calibrate the combination display-graphics board. In that case Calibrator®Talk uses a computer signal to perform the re-calibration. This method is sometimes called *External* calibration.
- Measure button.
  This button starts the measurement of a screen color. The measurement is done by means of the Optisense®.
  Calibrator®Talk reads the three color components of the screen color, i.e. the amount of red, green, and blue in the color. It calculates these into the parameters of one of the following color spaces: CIE-XYZ, xyY, L*u*v*, or L*a*b*.
  You can also read the color components of the current white-point, calculated in the selected color space.

Communication... (File > Preferences)

This feature allows you to define the necessary settings to communicate with one or more Calibrators®.

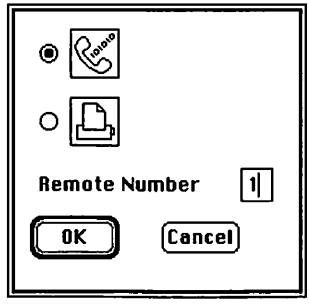


Figure 5.7

The Communication window contains:

- Remote number text box.

  Here you can enter the address of the display you want to control. This is especially meant for applications where more than one display is controlled by one single computer.

  You cannot set the address of each display via Calibrator®Talk. You must use the control menus of the display itself.

- Serial port selection.

  This is the serial port you connect to the display's Remote In plug, and through which the program communicates with the display.

You can select between the Modem port and AppleTalk port.

You can select between COM1 and COM2.

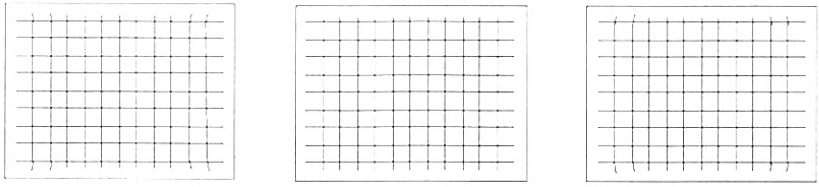
You can select between Port A and Port B.

If the serial port is not properly set at time of start-up, Calibrator®Talk will not start.

Corners (Geometry)

Only for Calibrator® and Calibrator®II

The corner correction corrects for distortions in the corners of your image.



Bad Good Bad

Figure 5.8

Adjust by:

- Clicking the up/down arrows next to the Corners box.
- Directly entering a numeric value in the Corners box.

Default Correction (Gamma)

Sets the RGB-look up tables of your computer to a gamma law which is the default LUT stored in the computer.

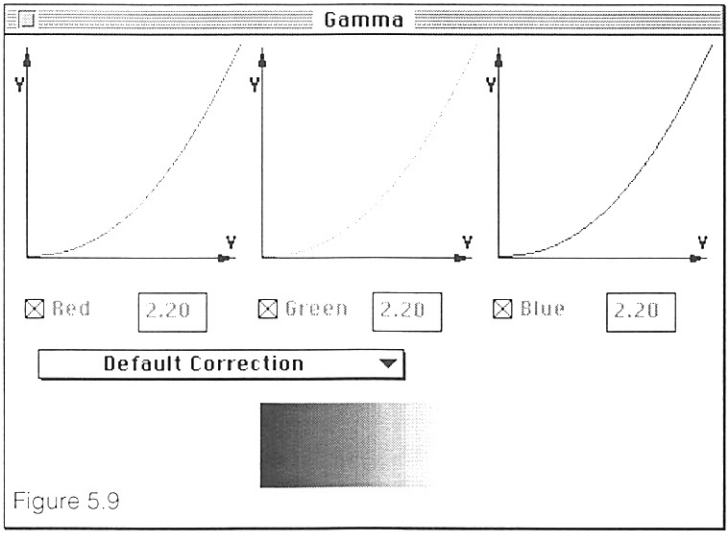


Figure 5.9

The Default Gamma window contains the following items:

- Three curves that show the default gamma for the three colors: Red, Green, and Blue.
- Three text boxes with the default gamma values, corresponding to the curves.
  They are grayed, indicating that you cannot change them.
- Also the Gamma link boxes are grayed, indicating you cannot select or deselect them.
- A gray-scale pattern that shows the result of the gamma function.

Degauss

Demagnetizes the CRT of the Calibrator®. This function can be used whenever local magnetic fields have an influence on the image quality.

You can find the degauss function in the main window.

There is always an automatic degaussing at power on.

Whenever the degauss is activated every other function is locked for a while.

Exit (File menu)

Only on Windows.

Selecting this option, you close the Calibrator®Talk program.

Export (File menu)

You can use this function to export the color-depending parameters ("the passport") of the display to a Color Management System, if installed on your system.

File menu

The file menu contains the following functions:

- Load gamma
- Save gamma
- Preferences
- Export
- About
- Exit

For more information about these items, please refer to their respective entry in this chapter.

Fine (vertical shift) (Geometry)

Only for Calibrator® and Calibrator®II

Fine adjustment of the vertical image position.

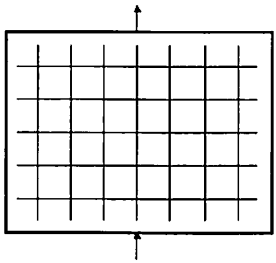


Figure 5.10

Adjust by:

- Clicking the up/down arrows next to the Fine box.

Gamma

The gamma manipulation allows you to control the overall gamma of your system, i. e. the product of the real display gammas and the color values in the Look Up Tables (LUT) of the graphics board.

The real gammas of the three colors of the picture tube are fixed. You can read them in the CCP window. The Calibrator®Talk Gamma function reads the real gamma values of the picture tube and calculates the correction values in the LUT to obtain the overall gamma you set in Calibrator®Talk.

The Gamma window contains the following items:

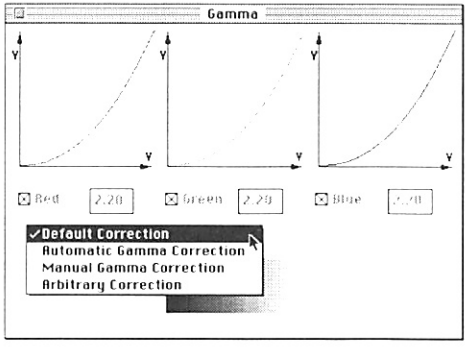


Figure 5.11

- Three curves that show the current gamma for the three colors: Red, Green, and Blue.
- Three text boxes with the current gamma values, corresponding to the curves.
  They can be grayed or active, depending on the kind of gamma correction you choose.
- Gamma link boxes to link two or all three gammas. They can be grayed or active, depending on the gamma correction you choose.
  Gammas that are linked always have the same value.
- A gray-scale pattern that shows the result of the gamma function.
- The Gamma correction selection box that lets you select between four options:
  - Default correction, corresponding to the parameters of your monitor.
  - Automatic correction, taking different ambient conditions into account.
  - Manual correction, allowing you to enter any number between 0.1 and 10.
  - Arbitrary correction, allowing you to enter any possible gamma curve.

Geometry

In this window you can completely control the image size and image position.
It is also possible to correct for some geometric distortions should any become visible over time.

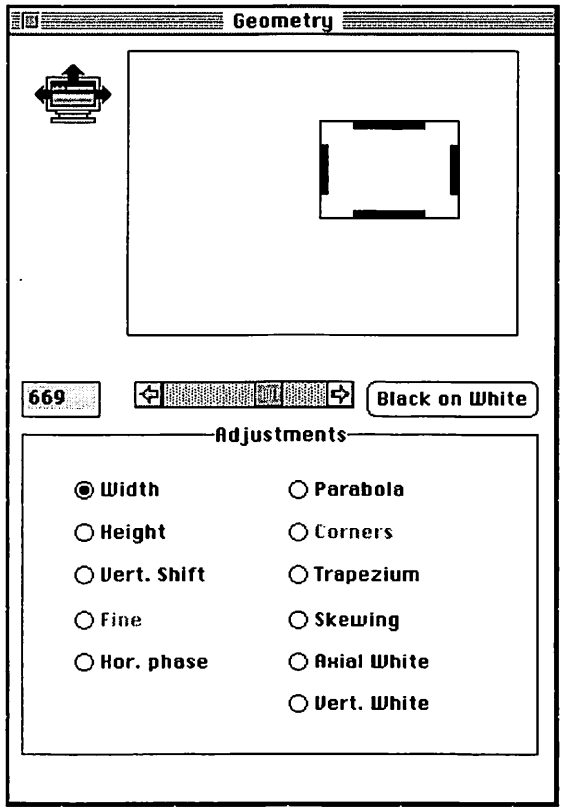


Figure 5.12

The Geometry window contains:

- The crosshatch pattern as reference during the geometry adjustment. The pattern is normally made of white lines on a black background. For uniformity adjustments you can reverse the pattern to black lines on a white background.

- A rectangular icon In the upper half of the window that represents your image.
  The icon has four handles on the edges. You can drag the handles or drag the complete icon.
- Width adjustment.
  Changes the picture width.
- Height adjustment.
  Changes the picture height.
- Vertical Shift adjustment (coarse).
  Shifts the image up and down.
- Fine adjustment (vertical shift).
  Fine adjustment on the vertical image position.
- Horizontal Phase adjustment.
  Shifts the image horizontally.
- Parabola adjustment.
  If the left and right edges of your image look curved then the parabola will get them straight again.
- Corners adjustment.
  Corrects for distortions in the corners of your image.
- Trapezium adjustment.
  If your image looks like a trapezium this correction will adjust it back to a rectangle.
- Skewing adjustment.
  This is an adjustment to make vertical lines of the image perpendicular. First make sure the vertical lines are parallel using the 'Trapezium' control.
- Axial White adjustment.
  Compensates for disturbing magnetic fields in the axial direction of the monitor.
  Such a field will have the effect of rotating your image a little bit.
- Vertical White adjustment.
  Compensates for disturbing vertical magnetic fields in the southern hemisphere.
  Changing this parameter will have no effect if the option is not installed.

Caution: Drastic geometry changes affect the color fidelity. Better re-calibrate after geometry adjustment.

With Reference Calibrator® and Mega Calibrator® displays, the geometry settings are not automatically stored. They are lost when you switch off the display, unless you have stored them as a Monitor Setup (refer to "Monitor Setup").
When you work with Calibrator® or Calibrator®II displays, the geometry settings are automatically saved.

Graphic Boards... (File > Preferences)

This option is only present on Macintosh version.
It lets you select the graphics board the computer communicates with in case more than one board is mounted.

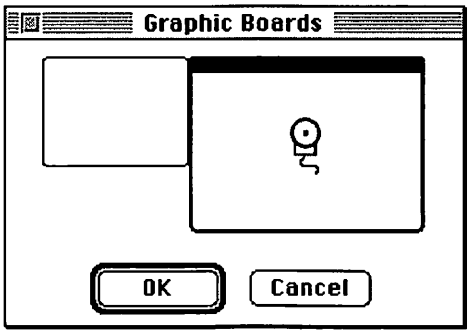


Figure 5.13

The Graphic Boards window is similar to the Macintosh **Monitors** control panel.

The rectangular icons in the window represent the monitors connected to the different graphics boards in your computer. They are drawn in proportion to their physical size.
One of them is highlighted and contains the drawing of an Optisense® device. This represents the display you are currently controlling.

Select the board your Barco Calibrator® display is connected to by clicking its icon.
As a consequence all the Calibrator®Talk windows are repositioned to the selected monitor.

Remark: The Graphic Boards window differs from the Macintosh **Monitors** control panel in the following points:

- The menu bar will not reposition itself to the selected screen.
- You need not reboot the computer before the changes take effect.

Height (Geometry)

Changes the picture height.

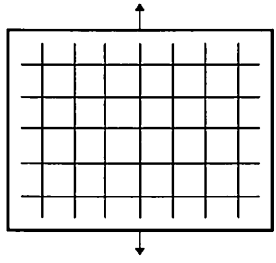


Figure 5.14

Adjust by:

- Clicking the up/down arrows next to the Height box.
- Directly entering a numeric value in the Height box.
- Dragging one of the horizontal handles in the icon in the top of the geometry window up or down.

Help menu

The Help function displays the list of topics on which you can get help.

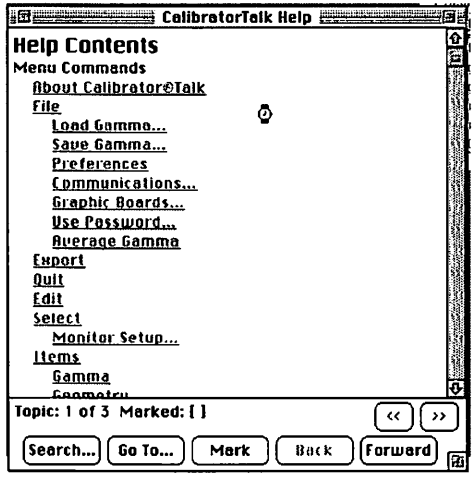


Figure 5.15

To get help on a topic:

• Click an item from the list of topics.

To quit the Help function:

• Click **Cancel**.

When you get help on a topic, the Help window appears.

It contains the following buttons:

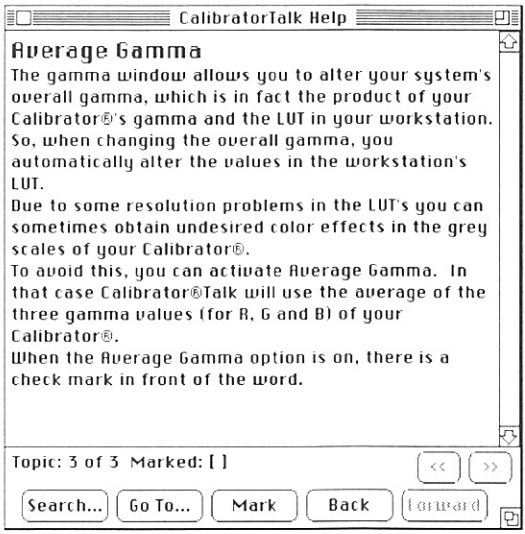


Figure 5.16

• Search: Search for a specific topic or keyword.
• Go To: View the topics list as index or glossary and view bookmarks.
• Mark: Set bookmarks for easy search.
• Back: Go back one step.
• Forward: Go forward one step.

Hor. Phase (Geometry)

Shifts the image horizontally.

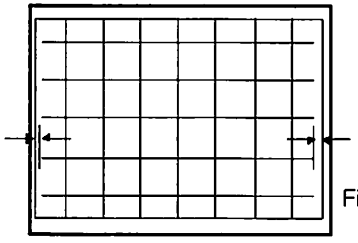


Figure 5.17

Adjust by:

- Clicking the up/down arrows next to the Hor. phase box.
- Directly entering a numeric value in the Hor. phase box.
- Clicking in the middle of the icon in the top of the geometry window and dragging the icon to left or right.

Items menu

This selection is added in the main menu bar for users without a mouse, so they can select the functions in the main window by selecting this menu:

Gamma...
Geometry...
Color...
CCP...
Degauss
ALC (checkable)

Load Gamma (File menu)

This function allows you to load an Arbitrary Gamma Correction from a file.

In the Load Gamma window you can select a gamma file.
If necessary first select the folder (directory) where the gamma files are stored.

LUC (Luminance Uniformity Correction)

This box in the main window is only accessible in case your computer is connected to a Mega Calibrator display. It allows you to switch the Luminance Uniformity Correction of the display on or off.
When switched on while starting an Autocal, the display will re-calibrate its LUC system after the usual color calibration.

Manual Gamma Correction

Manual Gamma lets you manually enter a Gamma value for the three colors. Next to the colors you see boxes. Select these boxes to 'link' the corresponding colors. This means that, if you change one of them, the others will change accordingly.

The Manual Gamma window contains the following items:

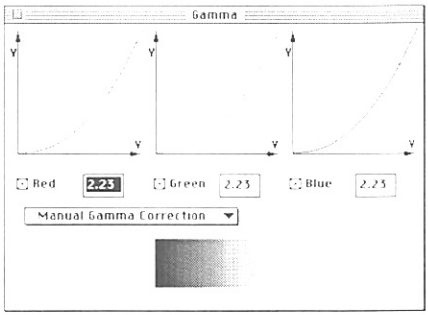


Figure 5.18

- Three curves that show the current gamma functions for the three colors: Red, Green, and Blue.
- Three text boxes with the gamma values corresponding to the curves. Enter the new gamma value here.
- Three boxes that can 'link' two or all three gamma values. If you change one of the linked ones, the other(s) change accordingly.
- A gray-scale pattern that shows the result of the gamma function.

Remember: The higher the gamma value you enter, the darker your image will be.

Measure (Color)

This feature allows you to measure a particular color on the screen by placing the Optisense® upon this color.

The Measure window contains:

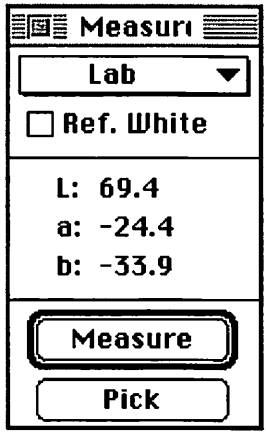


Figure 5.19

- CIE-1931-XYZ option.
  If selected, the measured color will be expressed in (X,Y,Z) coordinates, according to the XYZ color space, defined by the CIE (Commission Internationale d' Eclairage) in 1931.
- CIE-1931-xyY option.
  If selected, the measured color will be expressed in (x,y) coordinates, according to the CIE-chromaticity diagram, defined by the CIE in 1931. Y represents the color's luminance.
- L*u*v* option.
  If selected, the measured color will be expressed in the parameters L*, u*, and v*, the three elements of the L*u*v* color space, accepted by the CIE in 1976.

u* and v* are color-dependent, while L* represents the luminance. An L* value of 0 corresponds to black, and a value of 100 corresponds to white (reference white). So the L*u*v* values always relate to the reference white you have selected.

- L*a*b* option.

  If selected, the measured color will be expressed in the parameters L*, a*, and b*, the three elements of the L*a*b* color space, accepted by the CIE in 1976.

  Just like with L*u*v*, a* and b* are color-dependent, while L* represents the luminance. An L* value of 0 corresponds to black, and a value of 100 corresponds to white (reference white). So the L*a*b* values also relate to the reference white you have selected.

* Reference white.

  If you select this option, Calibrator®Talk will list the parameters of the selected reference white. Their values are given in the units of the selected color space.

- Pick function.

  If you click this button, a pippette appears, by means of which you can pick a color to measure. The picked color fills the whole screen.

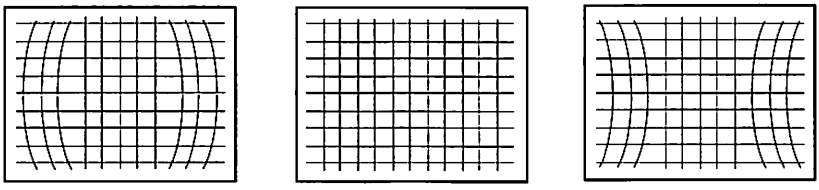
Remarks:

- Should you perform color measurement on a computer that contains more than one graphics board, first select the board your Barco Calibrator® display is connected to. You can do this by means of the "Graphic Board..." option in the File-Preferences menu.
- We recommend to let the Optisense® warm up for fifteen minutes before you actually start the measurement.
- For precise measurement, we recommend to cover (the picture tube of) your Calibrator® during the measurement by means of your Ambient Light Shield.

Note: the color measurement feature is only active when your computer is equipped with a "True Color" graphics board.

Parabola (Geometry)

If the left and right edges of your image look curved then the parabola will correct those edges back to straight lines.



Bad Good Bad

Figure 5.20

Adjust by:

- Clicking the up/down arrows next to the Parabola box.
- Directly entering a numeric value in the Parabola box.

PICTURE

PICTURE adjusts the contrast of the image.

You can adjust PICTURE by means of the slider in the Main window. The value is indicated in the text box, left of the slider bar.

You can:

- drag the slider to the left (decrease) or the right (increase)
- click inside the slider bar, left or right of the slider (large steps)
- click the arrows, left or right of the slider bar (small steps)
- click the text box next to the slider bar and manually change the value

A value of 100 means: calibrated. Remember the colors on the screen are only truly calibrated when BACKGROUND and PICTURE are in calibrated position. So always put BACKGROUND control in CAL position when working with a Color Management System.

To put PICTURE in calibrated position:

- click CAL under the PICTURE icon
- set the PICTURE to 100

Preferences (File menu)

You can set the following preferences:

- Communications
- Use password...
- Average gamma (on/off)
- Sound (on/off)

For more information about these items, please refer to their respective entry in this chapter.

Quit (File menu)

Only on Macintosh.

Selecting this option, you close the Calibrator®Talk program.

Save Gamma (File menu)

This function allows you to save an Arbitrary Gamma Correction as text file on disk.
You can import and edit this file in a wordprocessor or spreadsheet program.

In the Save Gamma window Calibrator®Talk suggests a name and folder (directory) where to store the file. You can change both before saving.

Setup menu

The Barco Reference Calibrator® and Mega Calibrator® displays have an internal memory system that allows the user to store different graphics board modes. Moreover different settings can be stored for the same graphics board signal.

Barco Calibrator® and Calibrator® II displays, on the other hand, have three possible settings: one factory-defined setting (CAL) and two user-definable settings (PRESET 1 and PRESET 2).

The Setup menu allows you to:

- create a new monitor setup or change an existing one
- select one of the stored monitor setups
- remove one of the stored monitor setups

You can protect your Monitor Setups from accidentally being changed by another user. Therefore you need to select **Use Password...** in the Preferences. If you have installed your password, Calibrator®Talk will ask for the password before starting the installation procedure.
You can read more information about passwords in the "Use Password" section.

After installing a monitor setup or selecting **Select** or **Remove** from the Setup menu, the **Monitor Setup** window appears.

The Monitor Setup window contains:

- List of possible monitor setups.
  On Calibrator® and Calibrator®II, this list only contains the following possibilities:
  - CAL: This is the factory-calibrated setup.
  - PRESET 1: This is one user-definable setup.
  - PRESET 2: This is the other user-definable setup.

  On Reference Calibrator® and Mega Calibrator® displays you get the list of setups stored in the memory.

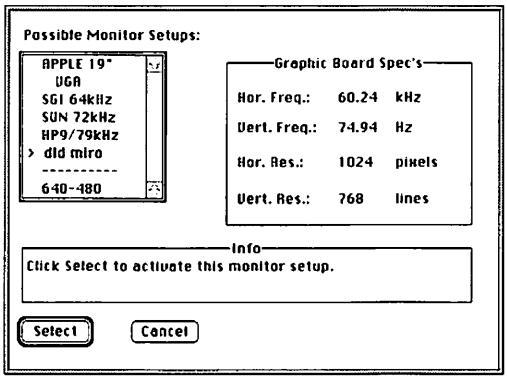


Figure 5.21

If there are spare places in the display's memory, you will find "Untitled" in the list. You can select this untitled setup and enter a new setup name in the Name text box.

If the display's memory is full, you will have to pick an existing setup from the list, and overwrite it with the new settings. In the Name text box you can enter a new name for this setup.

You can only select monitor setups that match the timing of the video signal applied to the display. You cannot change or delete factory-defined monitor setups.

- Name text box.
  Only appears on Reference Calibrator® and Mega Calibrator® displays.
  The setup you selected from the list appears in this text box.
  After having defined a new monitor setup, you can change the name in the text box.

- Graphic Board Specs.
  Only appears on Reference Calibrator® and Mega Calibrator® displays.
  These are the characteristics of the selected graphics board's video signal, measured by the display.

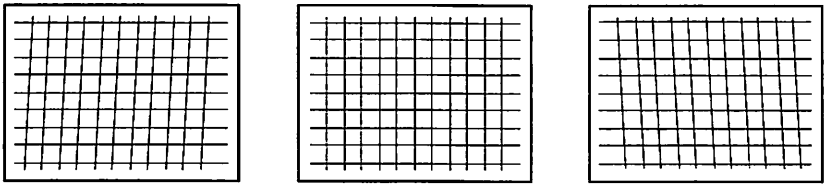
- Info box.
  Displays more information about how to use the monitor setup window, and what the restrictions are.

- Select button / Remove button.
  Click this button to select the setup you have chosen from the list of setups. Alternatively you can double-click a setup to select it.
  When choosing Remove, the Select button is changed into a Remove button.
  Click this button to clear the selected monitor setup.

- Cancel button.
  Click this button to close the Monitor Setup window without making any change.

Skewing (Geometry)

This is an adjustment to make vertical lines of the image perpendicular. First make sure the vertical lines are parallel using the 'Trapezium' control.



Bad Good Bad

Figure 5.22

Adjust by:

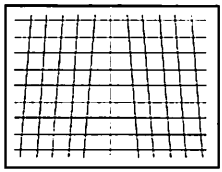
- Clicking the up/down arrows next to the Skewing box.
- Directly entering a numeric value in the Skewing box.

Sound on/off (File > Preferences)

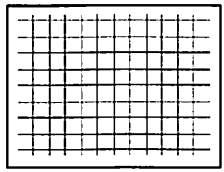
After successful or unsuccessful re-calibration or color measurement, the software generates an audible signal through the computer. The **Sound** feature in the Preferences allows you to switch these signals off. The default setting is **On.**

Trapezium (Geometry)

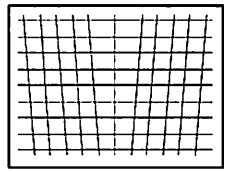
If your image looks like a trapezium this correction will adjust it back to a rectangle.



Bad



Good



Bad

Figure 5.23

Adjust by:

- Clicking the up/down arrows next to the Trapezium box.
- Directly entering a numeric value in the Trapezium box.

Use Password... (File > Preferences)

This feature allows you to install or remove your password.
If the password is installed, there is a check mark before the item in the menu.

In the Password window, enter your password twice to verify for any mistakes.

You can remove your password again by entering the **Use Password** option once more. The Password window appears again. Enter the existing password and click **OK**.
As a consequence **Use Password...** in the Preferences will be deselected.

The display comes with a blank password out of the factory.

Vert. Shift (coarse) (Geometry)

Shifts the image up and down.

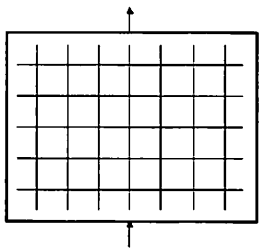


Figure 5.24

Adjust by:

- Clicking the up/down arrows next to the Vert. Shift box.
- Directly entering a numeric value in the Vert. Shift box.
- Clicking in the middle of the icon in the top of the geometry window and dragging the icon up or down.

Vert. White (Geometry)

This option is not available on all Calibrators®. The vertical white option also known as ULC (Universal Latitude Corrector) or Southern Hemisphere Option is especially useful in the southern hemisphere to compensate for disturbing vertical magnetic fields.
Changing this parameter on your Calibrator® if the option is not installed, will have no effect.

Adjust by:

- Clicking the up/down arrows next to the Vert. White box.
- Directly entering a numeric value in the Vert. White box.

More information concerning geometric corrections is found in the Calibrator® user manual.

Width (Geometry)

Changes the picture width.

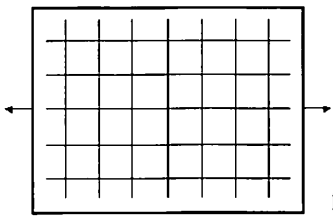
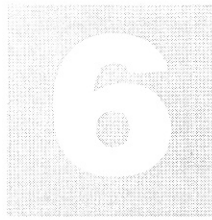


Figure 5.25

Adjust by:

- Clicking the up/down arrows next to the Width box.
- Directly entering a numeric value in the Width box.
- Dragging one of the vertical handles in the icon in the top of the geometry window to left or right.



TROUBLESHOOTING

Connection problem.

This problem occurs if there is a connection problem between the computer and the Calibrator·.
Check if the interface cable is properly connected and restart the Calibrator·Talk program.

This can also occur if a wrong or bad Optisense· is connected (not for Reference Calibrator·and MegaCalibrator·).

Lowlight underflow or overflow red, green or blue.

This can occur during the re-calibration of the display.
Please check the following:

Was changing ambient light affecting the calibration?
(It is strongly recommended to cover the display during re-calibration).

Was the optical sensor removed during the calibration?

Is the Optisense· free from dust and debris?

Is the picture tube of the display free from dust and debris?

Was the Optisense· measuring on the colored boxes which appear during calibration?

The white point specified in (x,y)-chromaticity is too far from the Daylight Locus.

The lifetime of the picture tube has expired.

Highlight underflow or overflow red, green or blue.

Was changing ambient light affecting the calibration?
(It is strongly recommended to cover the display during re-calibration).

Was the Optisense· removed during the calibration?

Is the Optisense· free from dust and debris?

Is the picture tube of the display free from dust and debris?

Was the Optisense· measuring on the colored boxes which appear during calibration?

The white point specified in (x,y)-chromaticity is too far from the Daylight Locus.

The lifetime of the picture tube has expired.

Optical sensor time-out, no data coming in.

Is the Optisense· connected to the screen?

Check the connection between the Optisense· head and the Optisense· amplifier (not for Reference Calibrator· and MegaCalibrator·).
Check the connection between Optisense· amplifier and the display (not for Reference Calibrator· and MegaCalibrator·).

If these suggestions don't work there may be a problem with the serial link or with the Optisense·, please contact your nearest Barco office.

Unstable readings from optical sensor.

Changing ambient light is possibly affecting the calibration procedure.

Let the Optisense® warm up for fifteen minutes and try the calibration procedure again.

Calibration loop overflow.

Usually caused by changing ambient light. Cover the display and try again.

Bad Optisense® or Optisense® does not match your Calibrator®.

(Not for Reference Calibrator® and MegaCalibrator®)
You probably use different Calibrators® and different Optisenses®
at your location. You probably used the wrong Optisense®
for re-calibrating the monitor.
You can select About Calibrator®Talk to determine which Optisense® goes with your Calibrator®.
The serial number shown here is also found on the Optisense® head.
Make sure that both serial numbers match.

Tracking PICTURE red, green or blue overflow.

Cover the display and calibrate again.
Tracking can sometimes take some time.

Tracking BACKGROUND overflow.

Cover display and calibrate again.

Optical sensor falls from the screen.

This is due to dust on the rubber. Don't use aggresive cleaners, they can damage the Optisense®.
Clean the screen. Special screen cleaner can be ordered at Barco.

APPENDIX A

ABOUT COLOR

Introduction

Almost every human being is very familiar with color, yet it is difficult to define what it really is. Although color is very real and concrete, we are compelled to reach for abstract terms when we want to grasp its nature. In the following chapters, we will try to clarify the complex combination of different factors through which color is born. Next we explain how a color display basically handles and creates colors. Finally we illustrate the problems with color in a complete color production system and how Barco's Calibrator®Talk software provides tools to solve them.

1. What is color?

We talk about color when we have a particular sensation in the brain, caused by light radiation of a certain wavelength that reaches our eyes[1]. This definition is built up from two parts that are quite different in kind. The first one is *psychological* in nature. It deals with the way the sensation of color is processed by the mind. The second one is merely *physical*: radiant energy. So color is in fact a *psychophysical* phenomenon: it interrelates both psychological and physical processes.

The psychological point of view

Artists and designers have a lot of knowledge of the complicated interaction of color: how colors are affected by their environment in a composition, how they can create harmony, contrast and rhythm. They talk about colors in subjective terms: hue, saturation and brightness. The terms hue and saturation are collectively referred to as the color's *chrominance*.
The *hue* of a certain color is its intrinsic nature. It is, when we observe a colored surface, that attribute of the visual sensation that makes us say: This surface is red, or magenta, or whatever color.
The *saturation* of a given color expresses its chromatic color intensity. A vivid color is highly saturated, as opposed to a pastel color of the same hue and with the same brightness. The colors of the rainbow have the highest saturation a color ever can have, whereas the complete absence of satura-

tion results in a shade of neutral gray, regardless of the hue. The shade of gray depends upon the brightness.

Brightness, at last, relates to the sense that a color appears to be reflecting more or less light energy. We talk about bright colors, in contrast to dim colors. Black is the complete absence of brightness for any hue.

Figure A-1 shows the three-dimensional color cone, representing the three color attributes[2]. Every horizontal cross-section of the cone is a color wheel, over which the different hues are spread. The highly saturated colors are located on the circumference of the wheel. Moving along the radius towards the center of the wheel, the saturation of every hue decreases, with a certain shade of gray as absolute minimum. The brightness, at last, is represented by the height of the cone. The apex corresponds to the absence of any brightness, thus black. The base of the cone is the color wheel that corresponds to the highest possible brightness.

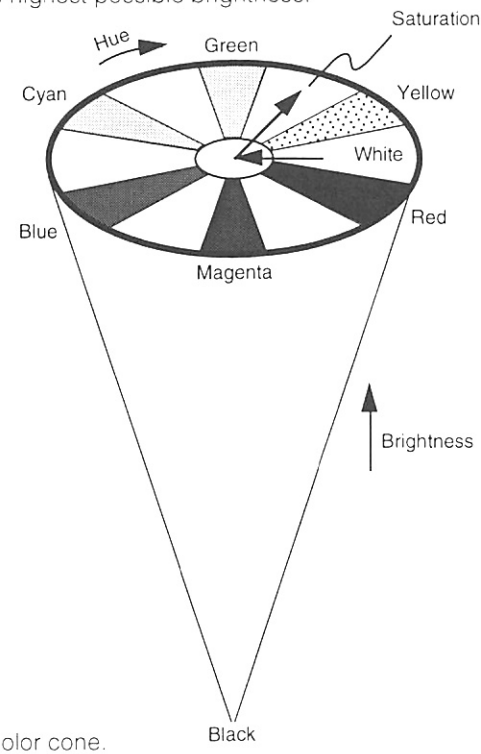


Figure A-1: Color cone.

The physical point of view

Scientists and technicians have a completely different approach on color. They want to express the human perception of colors in objective, quantifiable terms. But since all human beings vary in the way their minds process the perception of color, scientists can't describe this phenomenon in terms of a particular human being. They have to consider them in terms of an imaginary individual representing the "standard observer".
From a purely physical point of view, the production of color requires two or three elements: you certainly need a source of light and a kind of light recording element. This can be the human eye, a photosensitive device, etc. In many cases you additionally have an object that (partly) reflects the light. Each of the three elements is characterized by a specific spectral curve, i.e., a curve indicating its relative sensitivity towards light of different wavelengths.

The way in which our brain interprets our visual perception as color, depends from the spectral interaction of these three elements.

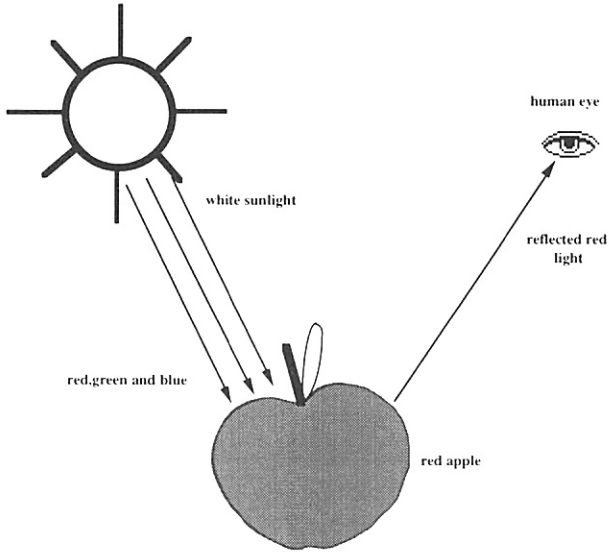


Figure A-2: Light source, reflective object, human observer.

The light source

In 1666 Isaac Newton discovered that white sunlight is composed of all the colors of the rainbow. Physically spoken, this means that white sunlight is a mixture of several electromagnetic rays with different wavelength. Every color corresponds to another wavelength. The complete visible light spectrum, as you can see in figure A-3, ranges from 380 nm (violet) to 780 nm (red).

The curve shown in figure A-3, which plots the relative intensity of light at each discrete wavelength in the visible bandwidth, is called a spectral curve. In this case it is the spectral curve of normal daylight.

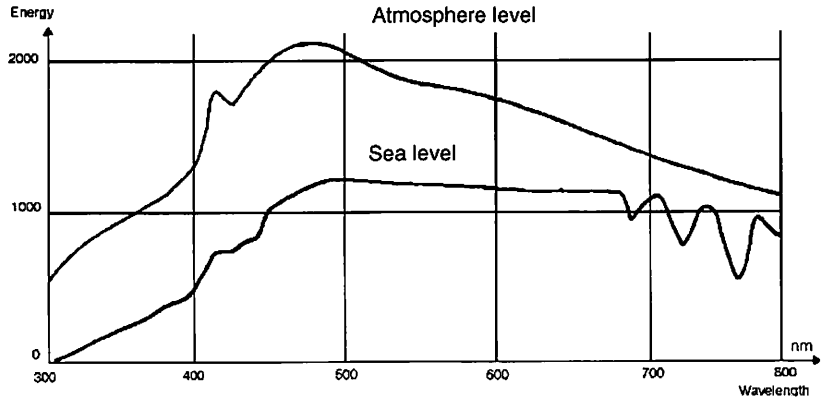


Figure A-3: Spectral curve of normal daylight

In fact we make a mistake by talking about "white light": in reality many 'white' light sources exist, going from reddish to bluish white. The reason is that every light source is characterized by a different spectral curve. Hence, it is easy to understand that the spectral characteristic of the light source influences the way we perceive the light as color. When we observe an object, its color looks quite different under a reddish light source than under bluish light.

Light sources are characterized by their so-called *color temperature*, expressed in Kelvin (K). A 100-watt tungsten lamp, as standardized by the CIE (Commission Internationale d' Eclairage) in 1931, has a color temperature of 2856 K. Indoor fluorescent light is represented by 4100 K and daylight from an overcast sky by 6500 K.

Color temperature

Color temperature is expressed in Kelvin, a temperature scale with zero point at -273.16°C or absolute zero. The link between temperature and color is made by a so-called blackbody radiator *whose emitted colored light depends on its temperature.*
An example of this phenomenon occurs when a metal is heated until it melts. The light that it emits changes from red over white to blue. The higher the temperature of the metal, the more bluish its emitted light. The color temperature of a particular white light corresponds to the temperature of the metal that emits that particular white. E.g., the white that is displayed on a computer monitor usually is 9300 K, which is rather blue. This is exactly the same color of a blackbody radiator heated to 9300 K (9026.84°C).
Depending on the circumstances, e.g., the time of the day, the white sunlight has a different color temperature. The set of color temperaures of normal daylight is depicted on a so-called daylight curve. *They are represented by D_c, where c refers to the blackbody color temperature they most closely simulate. E.g., D_{65} is daylight that slightly differs from 6500K.*

The influence of the object

We perceive a tomato as red and a lemon as yellow. This perception not only depends on the spectral characteristics of the light source and the human eye, but especially on those of the object itself.
The color of an object is due to the characteristic that it absorbs light from certain wavelengths and reflects light from others. The reflected light from different wavelengths results in the object's color. The tomato absorbs greenish and bluish light while it reflects reddish light.
This characteristic can be described in a so-called spectral reflectance or transmittance curve, showing the relative intensity of the reflectance of light at each discrete wavelength.

Figure A-4 shows the spectral reflectance curve of a number of common objects: a lemon, flesh, a tomato and a spring cabbage.

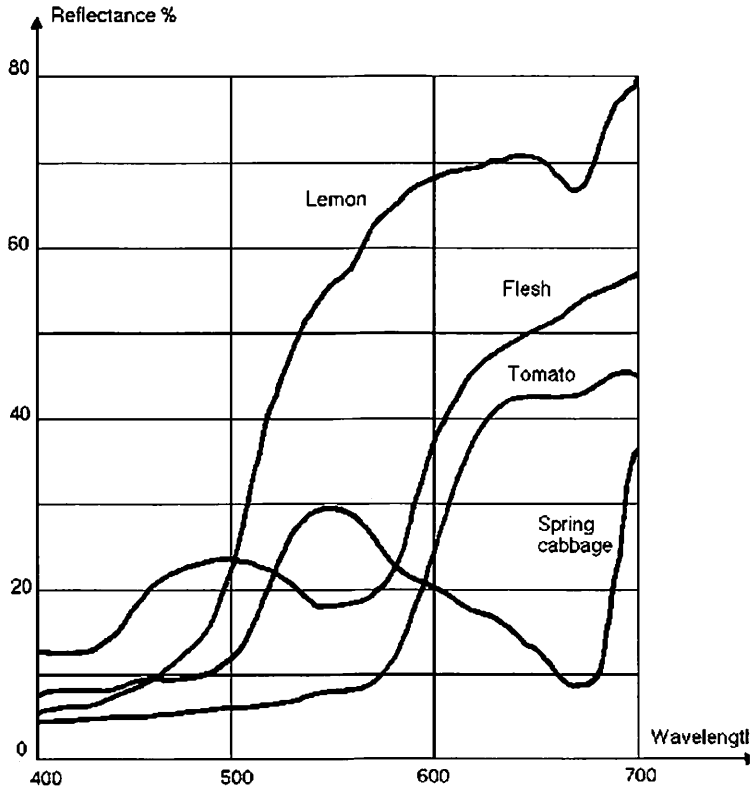


Figure A-4: Spectral reflectance curve.

How our eyes perceive colors

Just like any physical light source and any physical object, every light detector is more sensitive to certain wavelengths than to others. This is expressed in a spectral response curve. The detector we are especially interested in, is the human eye.

The mechanism of human color vision is based on the presence of light sensitive cells in the retina of the eye, called rods and cones. The cones are

sensitive to color. In fact the eye contains three types of cones. The first type is sensitive to red, the second one to green and the last one to blue light. Figure A-5 shows the spectral response curve of the three cones.

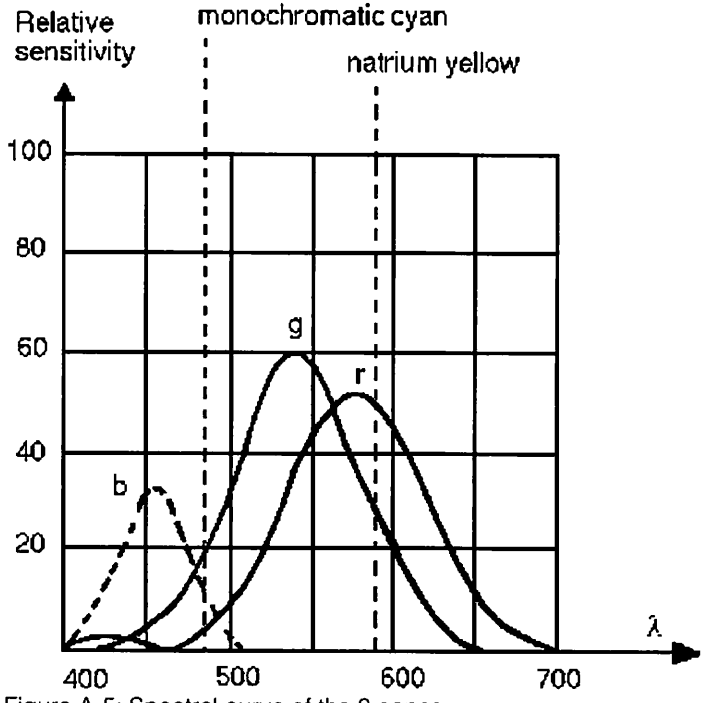


Figure A-5: Spectral curve of the 3 cones

So when red light hits the eye, the cones sensitive to red are excited, causing a particular sensation in the brain. That is what we call "red". This is what physically happens when we observe a tomato in neutral daylight: The sunlight, composed of electromagnetic waves with wavelengths from 380 nm to 780 nm, shines on the tomato. This one absorbs the light from 380 nm to 580 nm and reflects the light from 580 nm to 780 nm. This light reaches our eyes, where it excites the cones that have their sensitivity centered on 570 nm. The signals from these cones are finally processed by our brain. This particular sensation is called "red", we are taught.

Experiments have shown that every color sensation can be created by exciting two or three types of cones simultaneously. E.g., we perceive a color as magenta when both the red and blue cones are excited.
This principle, on which colorimetry is based, is called the *additive tristimulus theory*. It states that a wide range of colors can be matched by adding different amounts of three *primary colors*. Color displays are also based on this theory. The primary colors here are red, green and blue.

2. The standardization of color

In 1931 the CIE began to describe color in a quantitative, mathematical way. The basis of this work was formed by the scientists Wright and Guild who independently performed experiments on human color matching in the 1920s [3 4].

Color matching - The Standard Observer

The experiments of Wright and Guild tried to find out how the different colors of the spectrum can be matched by mixing the three additive primaries.

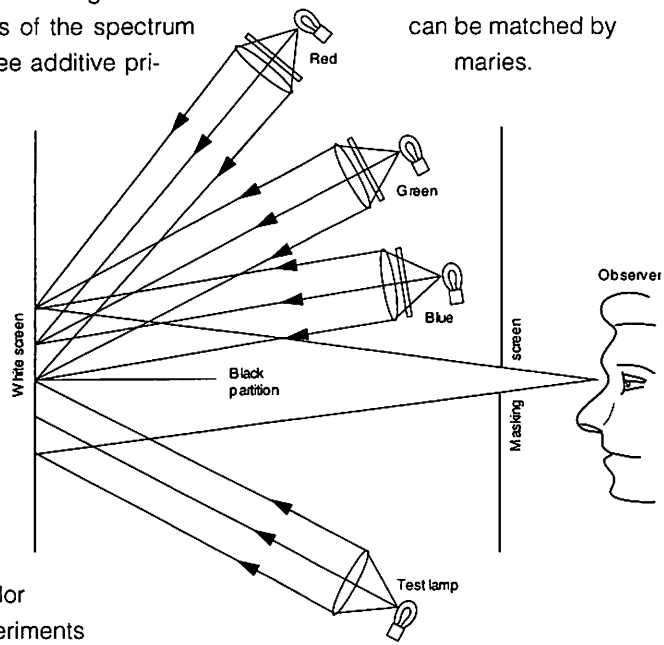


Figure A-6: color matching experiments

Therefore an observer was sitting in a darkened room, observing a circular field that was split in two halves (see figure A-6). One half was illuminated by the test color, the second one was illuminated by three independent, adjustable light sources: red, green and blue. The observer's task was to adjust the intensity of the three primaries until he thought the color on the field matched the test color.

Finally the scientists had an idea of the color vision of a 'standard human observer'. They knew how all the colors of the spectrum could be matched by mixing certain quantities of red, green and blue, according to the vision of a standard observer. The result of the experiment is shown in figure A-7.

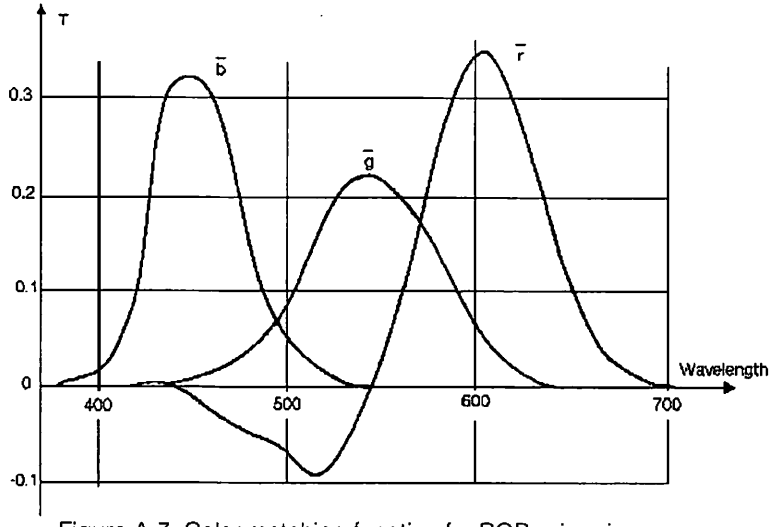


Figure A-7: Color matching function for RGB primaries

As you can see, the RGB model from the color matching experiments has a drawback: it contains some negative values. This means that you should add a negative amount of red to match a color with a wavelength of 500 nm. Of course this is very undesirable from the point of view of building an electro-optical device that reproduces what a human would see under the same circumstances (e.g., a color display). This phenomenon seemed to occur with all physically realizable sets of primaries. For that reason, in 1931, the CIE standardized to a set of primaries that were not physically realizable, but could match all colors with entirely positive values.

CIE - XYZ color space - (x,y)-chromaticity diagram

Based on the laws of Grassman[5], the CIE transformed the RGB values from the experiments of Guild and Wright by mathematical formulas into a set of new coordinates: X, Y, and Z.

The X and Z values have no specific perceptual correlates, but Y is a measure for the perceived brightness. In other words, Y represents luminance.

As all the colors seem to have three coordinates (X,Y,Z), we can represent them in a three-dimensional space, called a color space. The advantages of representing colors in a mathematical space are obvious: each color can be unambiguously defined by its coordinates and the visual difference between two colors can be expressed in a physical distance in the color space. This is especially interesting for the color industry, where people have to trade in painted products, specify the exact color they want to order and specify the tolerance in which the delivered color can differ from the ordered one.

A three-dimensional figure, however, is difficult to work with, so the CIE transformed the XYZ values into xyz, where x+y+z=1. This means that, if two values are known, the third one can immediately be calculated. So the z parameter is usually omitted. The result is a two-dimensional representation of the color spectrum, the well-known *(x,y)-chromaticity diagram*, as shown in figure A-8.

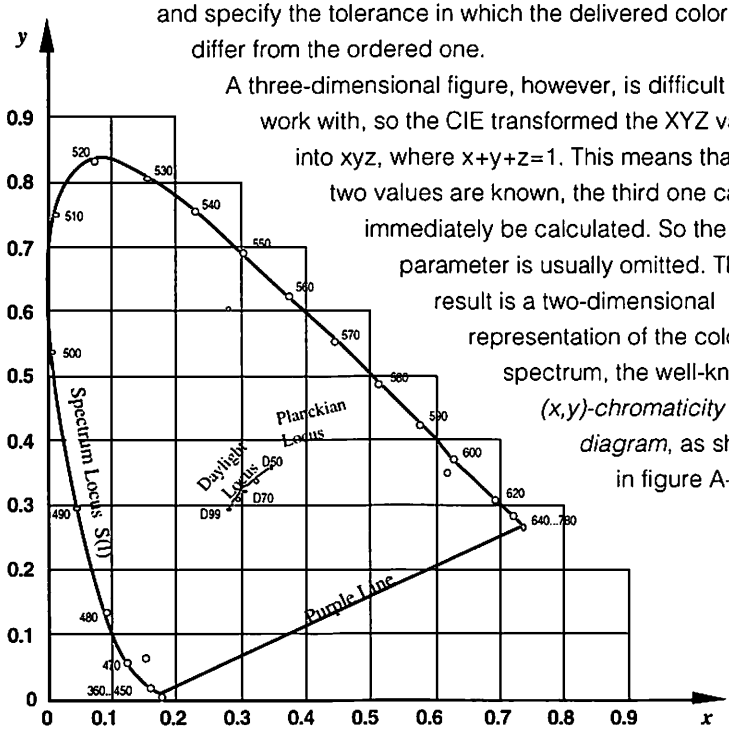


Figure A-8: The (x,y)-chromaticity diagram

*CIE - L*a*b* & L*u*v* color space*

The XYZ color space has one major drawback in practice: the Euclidean distance between two colors that are just noticeably different, is not the same over the whole color space. Such a color space is said to be not uniform.

This means that in the green area of the space, there can be a relatively large distance between two colors before a human observer notices a difference between both. In the blue area, on the other hand, differences are seen very quickly. The practical consequence is that color industry cannot use the same tolerance for every color. This phenomenon is shown in 1942 by MacAdam[6], who plotted the noticeable chromaticity differences

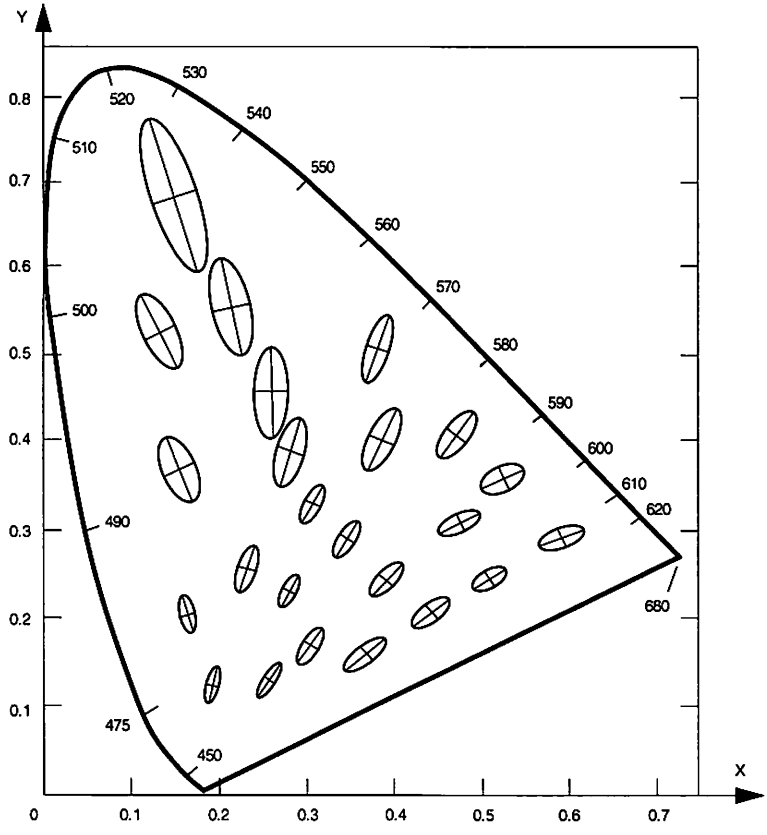


Figure A-9: The MacAdam ellipses.

as ellipses in the (x,y)-chromaticity diagram. This is shown in figure A-9. Each ellipse represents the difference in color that is not noticeable by a standard human observer.

This problem is solved in the so-called *uniform color spaces*. These are mathematical transformations of the XYZ color space where the Euclidean distance between two colors is proportional to the perceived difference between both.

The two uniform color spaces accepted by the CIE are called CIE L*a*b* & CIE L*u*v*, both accepted in 1976[7]. The former is mostly used for flat reflective color, whereas the latter is used for color displays.

3. How a display creates color

A color display, like the Reference Calibrator® or MegaCalibrator®, is a kind of light source. In fact, it contains three light sources: red, green and blue phosphors, that cover the glass of the picture tube. Due to additive color mixing, a whole range of colors can be created. This range is called the picture tube's gamut.

A display needs signals to activate its phosphors. These signals, video signals, are created by the graphics board inside the computer connected.

Additive vs. subtractive color mixing

In case of additive color mixing, mixing Red with Green results in Yellow. Green with Blue results in Cyan, and Blue with Red results in Magenta.

In case of subtractive color mixing, mixing Magenta with Cyan results Blue. Cyan with Yellow results in Green, and Yellow with Magenta results in Red.

As you can see in the above equations, the primary colors used in additive color mixing are Red, Green and Blue. For subtractive color mixing, they are Cyan, Magenta, and Yellow.

Additive color mixing occurs when mixing light. Subtractive color mixing occurs when mixing paints.

The picture tube

In a color display, the picture tube or CRT (Cathode Ray Tube) is the component to physically create colors. It therefore contains two important parts: an electron gun and a phosphor screen.

The glass of the picture tube is covered with thousands of red, green and blue phosphor dots. They emit light in case they are hit by moving electrons. And this is the role of the electron gun in the neck of the tube: to constantly fire electrons towards the phosphor screen.

The gun consists of three elements that independently fire different electron beams. The picture tube is designed so that the three independent electron beams hit different colors of phosphor: one beam only hits red phosphors, the second one only hits green phosphors and the third one only hits blue phosphors.

In case the three beams have the same strength, the three colors of phosphors glow in equal intensity. The result is a white color on the screen. It is obvious that, when we change the intensity of one of the beams, the intensity of the corresponding color changes, and so does the composite color on the screen.

In this way we can create all the colors that can be matched by mixing the colors of the phosphors used in the picture tube. Those are not all the existing colors in nature because the colors of the phosphors of a picture tube are less saturated than the primary colors red, green and blue of the rainbow. The complete range of colors that a picture tube can create is called the tube's color *gamut*. Colors that the tube cannot create are called *out-of-gamut colors*. E.g., the highly saturated, primary Process colors (Cyan, Magenta, and Yellow), are lying beyond the limits of today's picture tube's gamut. When a user wants to display such a color, his software application usually substitutes this color with the closest possible gamut color.

We can depict the colors in a two- or three dimensional figure. Figure A-10 is a two-dimensional representation of all possible colors. The triangle inside the figure contains all the colors that a picture tube can display. Colors outside the triangle are out of gamut.

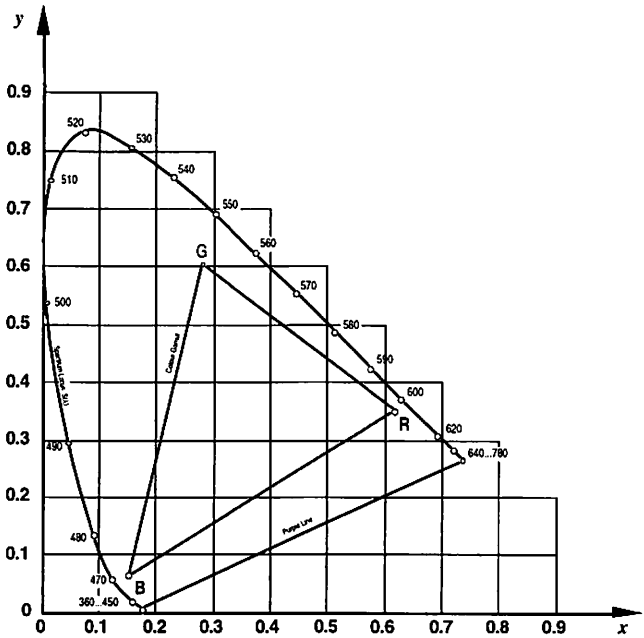


Figure A-10: Display gamut and out-of-gamut colors

The graphics board

The signals that eventually determine the intensity of the electron beams, thus determine the color of each point of the screen, are called the video signals. They originally come from the computer's graphics board and are processed by the display's electronic circuits before being applied to the picture tube.

Suppose you are working with a design program and making a color drawing. How does this drawing get to your display's screen?

The image you are making is always stored in the computer's image memory, where it is divided into a large number of picture elements. The color information for each element is called its color index value. Every color index value is separately stored in the image memory.

The computer's graphics board contains a so-called *Color Look Up Table* (LUT). This table transfers all the board's possible color index values to three digital values: for red, green and blue. If the color index value is

expressed in 8 bits, then the graphics board is a so-called 8-bit board. In this case the LUT contains 2^8 (=256) positions, through which it can display 256 colors simultaneously. These are derived from a palette of 16 million colors. The LUT decides which colors will be selected and under which circumstances. This means that different colors are continuously swapped in and out the LUT by different software applications. A 16-bit board can display 32,768 colors simultaneously and a 24-bit board 16,777,216. This is only theoretical, however: the number of colors displayed simultaneously can never be higher than the number of pixels of the picture tube (e.g., 1 million). Moreover the human eye cannot discern the difference between many of these different colors.

The three digital numbers at the output of the LUT are finally transformed into analog voltages by the DACs (Digital-to-Analog Converters) on the graphics board. These voltages are the video signals that enter the color display, that transforms them into electron beams that hit the phosphors in the picture tube. This is how the color gets on the screen.

The complete flow of color information is illustrated in figure A-11.

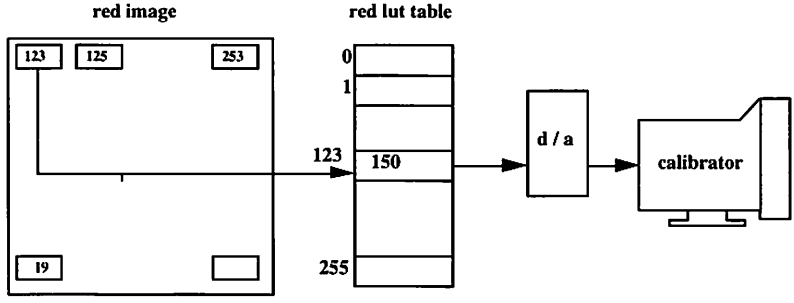


Figure A-11: Transfer of color information in graphics boards.

White point setting: absolute or simulated

As we have shown above, the way in which we perceive the color of an object partly depends on the light source that illuminates the object. The color of a dress might look different in plain daylight than in the shop where you bought it because of the difference in spectral characteristics between both light sources. Therefore it is important to view photographs and other

objects under standardized light sources in color production industry. This happens in so-called 'viewing booths'. On color displays, that are used as 'soft proof' devices in these environments, this very same condition is obtained by setting the so-called *white point* or color temperature.
The color on a display's screen is white when the red, green and blue phosphors glow identically. When the intensity of one or two phosphors slightly changes, the color tone of the white also slightly shifts towards red or towards blue. In this way the color temperature of the white changes.
When you have an image on your screen, e.g., a scanned photo, it is important to set the white point of the display equal to the color temperature of the light source that illuminates the original photo.
There are two ways to set the display's white point. The first is to actually change the parameters of the video amplifiers inside the display. This is a real alignment, referred to as *absolute* white point setting. The second technique is to simulate the desired white point by controlling the digital values supplied to the DACs on the graphics board. This is called *simulated* white point setting because the display is electronically aligned to another color temperature than the desired one[8].
The Reference Calibrator® and MegaCalibrator® displays allow the user to do absolute white point setting in an easy and quick way.

4. Color production systems

The complete system + the role of the display

Let us consider a color production system that consists of a scanner as input, an image processing and page assembly workstation, a proofing printer, and an imagesetter as output. The workstation is connected to a color display.
The color display serves as a visual reference to the system operator during activities such as color correction, image enhancement and cleanup, retouching and page assembly. At the various points in the operator's workflow where color accuracy is important (e.g., color correction), the display serves as a soft proof device. In terms of production cost, every output of the system, even a proof print, is expensive. The image on the

display, on the other hand, is relatively cheap[9]. Therefore the operator is relying on the display to accurately and predictably depict how a final prepress proof of the color will appear. Now what are the conditions under which the display can fulfill this role?

The first condition is that the color gamut of the display approaches that of the hard copy device as close as possible. If not, the display cannot create most of the possible colors that the system can print out, thus color fidelity is not possible.

Second, the display must have the same surround conditions as will be used to observe the hard copy output. As we have discussed above, this is met by setting the white point of the display. It must be equal to the color temperature of the light source under which the hard copy output is observed. Moreover it is obvious that this white point must remain stable in the long term.

Gamma of every component

An important characteristic of each component in the color production system, is its Gamma. It is a number that indicates the relationship between the signal values at input and output of a particular device. A Gamma of 1 indicates a linear behavior. This means that the device's output is directly proportional to its input.

This is the case with most of the scanners. They convert light into RGB video voltages. If the scanned image contains a color of 60% of full-scale red (thus medium red), the resulting output will also be 60% of full-scale red.

A color display, on the other hand, has a non-linear color behavior. If the video signal at the input contains a value of 60% of full-scale red, the image on the screen may be only 30% of full-scale red (thus dark red). This is why a scanned image normally looks darker when it is shown on a display. This behavior can be graphically displayed in a so-called Gamma curve, like shown in figure A-12.

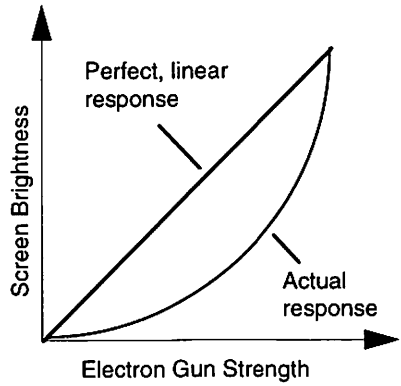


Figure A-12: The Gamma curve of a color display

Gamma correction can change this behavior. This is done by recalculating the values in the graphics board's Look Up Tables so that the overall Gamma of graphics board - display is altered. In this way we can obtain an overall Gamma of 1, so that the display seems to behave in a linear way. E.g., if the display's Gamma is 2.2, the Gamma correction should be 0.45 to obtain an overall Gamma of 1 (2.2 x 0.45 = 1). This is shown in figure A-13.

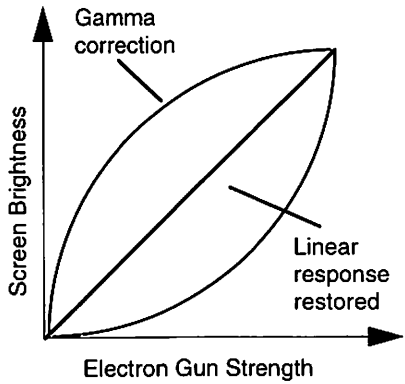


Figure A-13: Gamma correction

As a general rule we can say that the higher the Gamma value, the darker the output will be.

The problem with color

A color production system consists of several devices that all deal with color at some level. Because all these components in the system handle color in a different way, color communication between them is not so obvious. They use different color models, have different color gamuts and different Gammas. Moreover their colors are influenced by calibration and environment.

Different color models

The first problem is that the devices describe color in device-dependent terms. Color displays and most scanners work in RGB because they are based on the additive color mixing theory.

Printing devices, on the other hand, are partly based on subtractive color mixing (see above). The inks they use serve as filters. They absorb certain colors and reflect others. The color of the ink as we perceive it, is the result of the reflected color. This is in fact subtractive color mixing. The primaries used here are **C**yan, **M**agenta and **Y**ellow. They are combined with blac**K**, hence we talk about **CMYK** when talking about printing devices.

Different gamuts

The second problem is that the different devices in the system all have other color gamuts. Colors that can be created on one device can be beyond the possibilities of the other devices.

Gamma differences

Every component in the system can have a different Gamma. As we have explained above, this has an important influence on the way an image is processed.

Moreover the combination of all the Gammas in the system results in an overall Gamma. If you transfer an image from one system to another one with another overall Gamma, the image will look quite different on both systems.

Device calibration

There are not only differences between different devices in a system, there can also be color differences between identical devices of the same brand and model. This problem occurs if they are not calibrated in the same way.

Environment

Surrounding light is very important when it comes to judging color. Therefore accurate color matching must take the surrounding light color temperature into account. But the light a scanner uses to scan an image can be different from the white point setting of the color display.

Barco's answer[10]

Absolute white point calibration

A common technique in color displays is the simulated white point setting (see above). However it is shown that this technique results in a loss of color gamut of the display[10]. Hence it is obvious that absolute white point setting is a basic necessity for the optimal reliability of a soft proof display in color critical applications.

The Barco Reference Calibrator® and MegaCalibrator® displays allow quick and easy absolute white point calibration thanks to the connected Optisense®. Moreover it offers the choice among 5 different white points: three factory-defined and two user-definable color temperatures.

External calibration

The Calibrator®Talk software allows to perform so-called external calibration of the displays. This means that the video levels from the graphics board are used during calibration.

In this way the combination graphics board - display is in fact calibrated so that all the errors between board and display are eliminated.

Gamma correction

The Calibrator®Talk software allows to set the overall Gamma of the graphics board - display combination. You can choose between a number of preset Gammas or set the Gamma manually. In case of Arbitrary Correction, you can even form any correction function you want.

Wide color gamut

The Barco Calibrator® - type displays are equipped with special CRTs. Their phosphors guarantee a wider color gamut.

Stability of color circuits

The video amplifiers inside the Barco Calibrator® - type displays are very stable thanks to a number of feedbacks and locked loops. As a result the colors on the screen are also very stable.

Stability of white-point

The EAKB (Enhanced Automatic Kinescope Bias) system inside the Barco Calibrator® - type displays guarantees long-term stability of the white point.

The CCP file: the display's unique passport for Color Management Systems

A Color Management System (CMS) overrules the above-mentioned drawbacks of a color production system by translating the color behavior of all the devices in the system in a universal, device-independent way. Therefore the CMS needs a kind of passport of each individual device. In most cases the display manufacturer delivers a standard passport file to the CMS, hereby ignoring the existing differences between displays of the same brand and model.

Each individual Barco Calibrator® - type display has its own passport: the so-called CCP file. The Calibrator®Talk software can transfer this file to the CMS. In this way, each display is perfectly and unambiguously known by the CMS.

Reference

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(3) J. Guild, "The Colorimetric Properties of the Spectrum", Phi. Trans. Roy. Soc. (London), A 230, 149 (1931)

(4) W.D. Wright, "A re-determination of the trichromatic coefficients of the spectral colors", Trans. Opt. Soc. 30, 141 (1928 - 1929)

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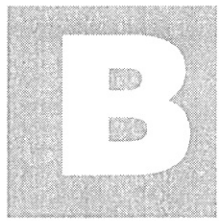
(6) D.L. MacAdam, "Maximum Visual Efficiency of Colored Materials", J. Opt. Soc. Am..., 25, 361-7 (1935)

(7) CIE, "Recommendations on Uniform Color Spaces, Color-Difference Equations, and Psychometric Color Terms", Suppl. No. 2 to "Colorimetry", Publ. No. 15. Bureau Central de la CIE, Paris (1978)

(8) E. Jennings and B. Thompson Pearce, Monitor Color Gamut Changes under White Point Simulation", Intergraph Corporation, El. Pub. Div., Huntsville, Al.

((9) J. Maelfeyt, "The Role of a Calibrated Imaging Display as a Soft Proofing Device in Photographic Imaging", Barco Video & Communications (Belgium) (1992)

10) J. Maelfeyt, JP. Van Elstlande, JP. Van De Capelle, G. Carrein, "The Calibrator® Explained", Barco Video & Communications (Belgium) (1991)



APPENDIX B

VIDEO AND REMOTE CONTROL CABLES

You can order the following video cables at Barco:

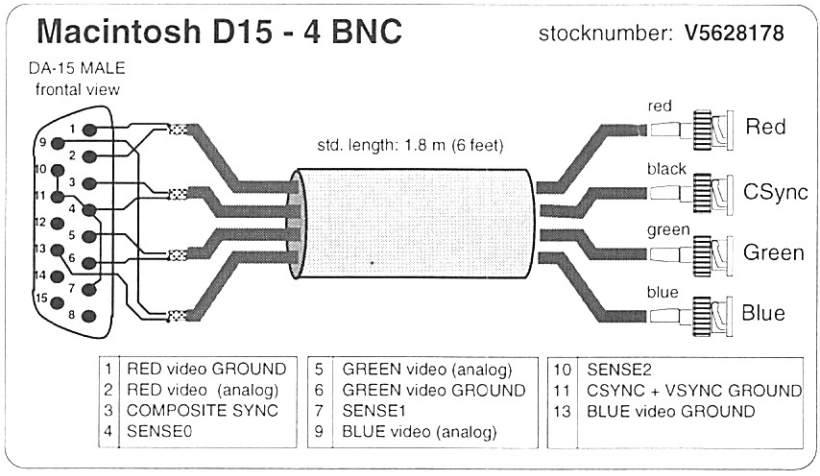


Figure B-1

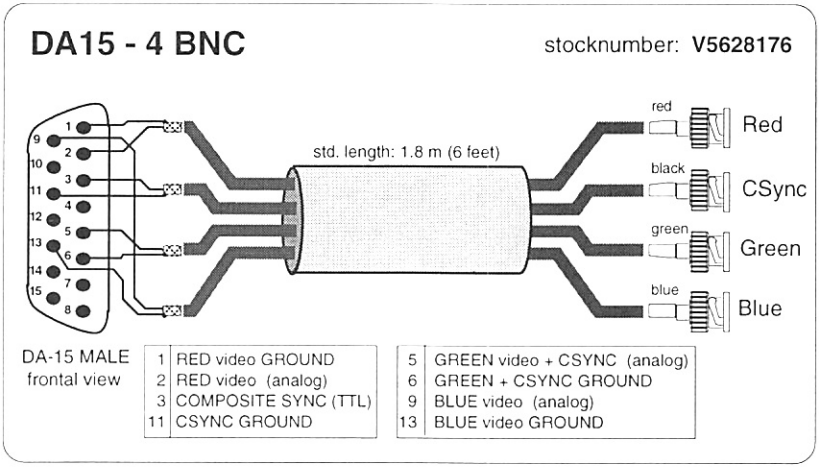


Figure B-2

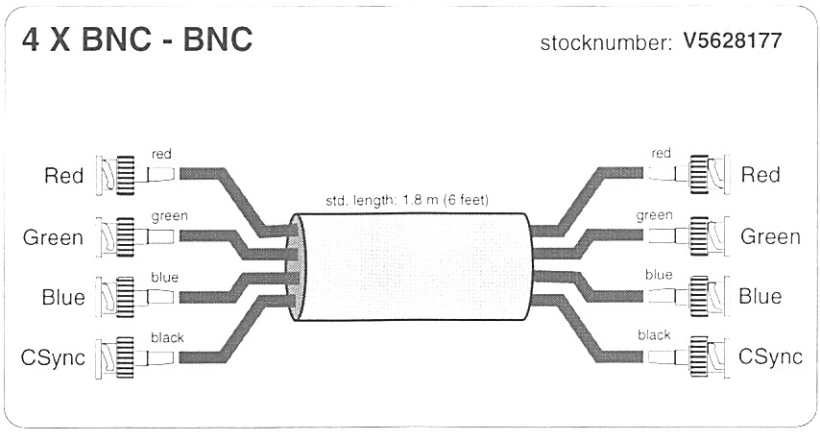


Figure B-3

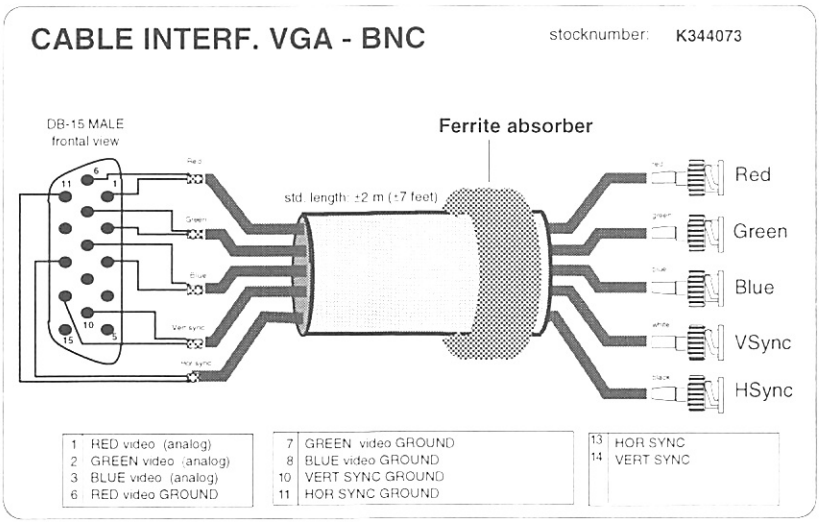


Figure B-4

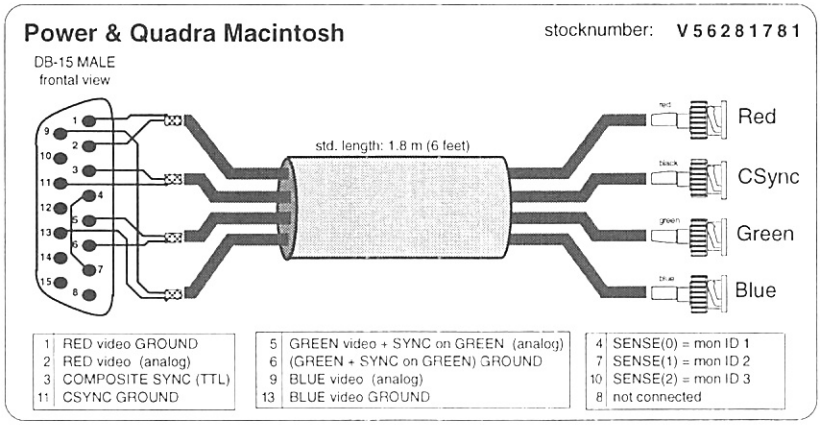


Figure B-5

The Remote Control cable, delivered with the display:

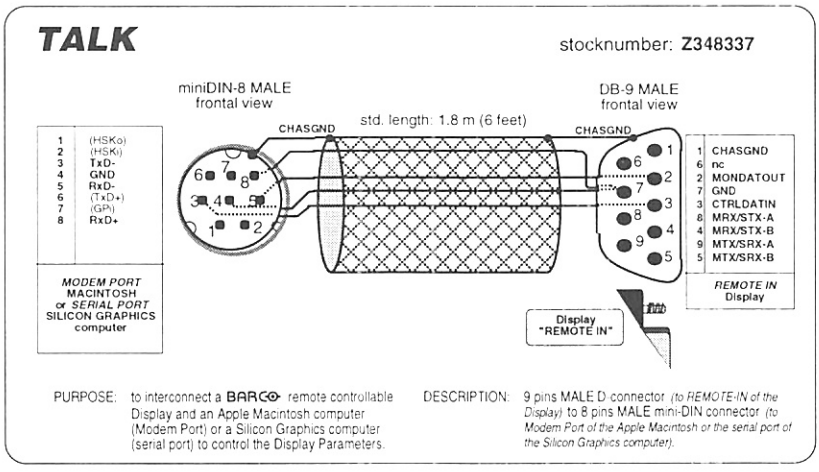
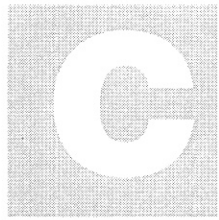


Figure B-6



APPENDIX C

GRAPHICS BOARDS (Windows)

The following boards have been tested for compatibility with Calibrator®Talk for Windows, especially for correct color Look Up Table handling.

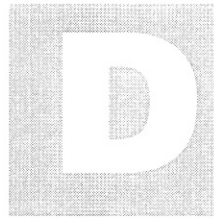
Manufacturer	Board type
ETAP	Greco
INFOTRONIC	IGP 64
INTERGRAPH	G91
MATROX	Impression
MATROX	Impression Ultra
MATROX	MGA, MGA-PCI/2, MGA-PCI/2+, MGA-PCI/4/200 **
NUMBER NINE	GXE64 Pro
TRUEVISION	1024-32
MIRO	Rainbow_Win
VIDEOLOGIC	Rapier 24

This list is subject to changes.

** The Matrox MGA boards have a ModeSWITCH function in their control panel. Don't switch to another mode while Calibrator®Talk is open.
Calibrator®Talk can't detect this mode switch.
Close Calibrator®Talk before switching to another mode.
Never check "ModeSWITCH" if the MGA drivers are version 2.00.

You can use other boards than the ones in the above list, with the following restrictions:

- They are assumed to have a calibrated output signal, e.g., full white is 700 mVpp.
- Color measurement will be disabled.
- Gamma control function will be disabled. Your overall gamma will be determined by the application you are working with.
  For 24-bit color boards you can assume that your overall gamma will be set to 2.2. This is the result of the display's gamma (2.2) and the Look Up Table (Linear).
  For 8 to 24-bit color boards the colors will be completely determined by the board's Look Up Table. This means that they are not reliable from the color point of view.



APPENDIX D

GENERIC DISPLAY VALUES

When you work with a Color Management System that doesn't automatically support Calibrator®Talk, you can supply the necessary information about your display by entering the following values in the CMS:

For Reference Calibrator®:

Open the CCP window in Calibrator®Talk. Here you find the information for the CMS.

For Calibrator® and Calibrator®II:

Generic Parameter Table for BARCO displays	Color Temp	Red Phosphor		Green Phosphor		Blue Phosphor	
		x	y	x	y	x	y
Calibrator®	6500K	0.618	0.35	0.281	0.593	0.151	0.064
Calibrator®	5000K	0.618	0.35	0.281	0.593	0.151	0.064
Calibrator®II	6500K	0.637	0.34	0.278	0.6	0.147	0.062
Calibrator®II	5000K	0.637	0.34	0.278	0.6	0.147	0.062

Generic Parameter Table for BARCO displays	Color Temp	White Point		Gamma		
		x	y	red	green	blue
Calibrator®	6500K	0.3128	0.3292	2.2	2.2	2.2
Calibrator®	5000K	0.3457	0.3587	2.2	2.2	2.2
Calibrator®II	6500K	0.3128	0.3292	2.2	2.2	2.2
Calibrator®II	5000K	0.3457	0.3587	2.2	2.2	2.2

APPENDIX E

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